Burnside School, Christchurch

June 14th 2016

Geography and Health

UC
UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

Prof Simon Kingham
Dept of Geography & GeoHealth Laboratory

Mapping of Disease & Health

- Why do we map disease?

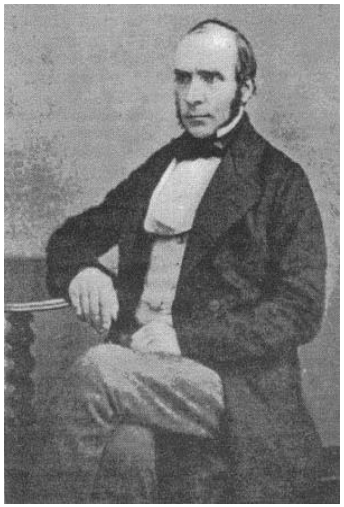
Spatial Analysis of Disease & Health

- A long history …
- Mapping and modelling communicable diseases & their diffusion e.g. influenza, HIV/AIDS, 'cholera'
- Identifying non-communicable disease clusters and their likely causes - focus on:
  - major life style diseases e.g. cancer, heart disease
  - rare diseases e.g. childhood leukaemia, type 1 diabetes

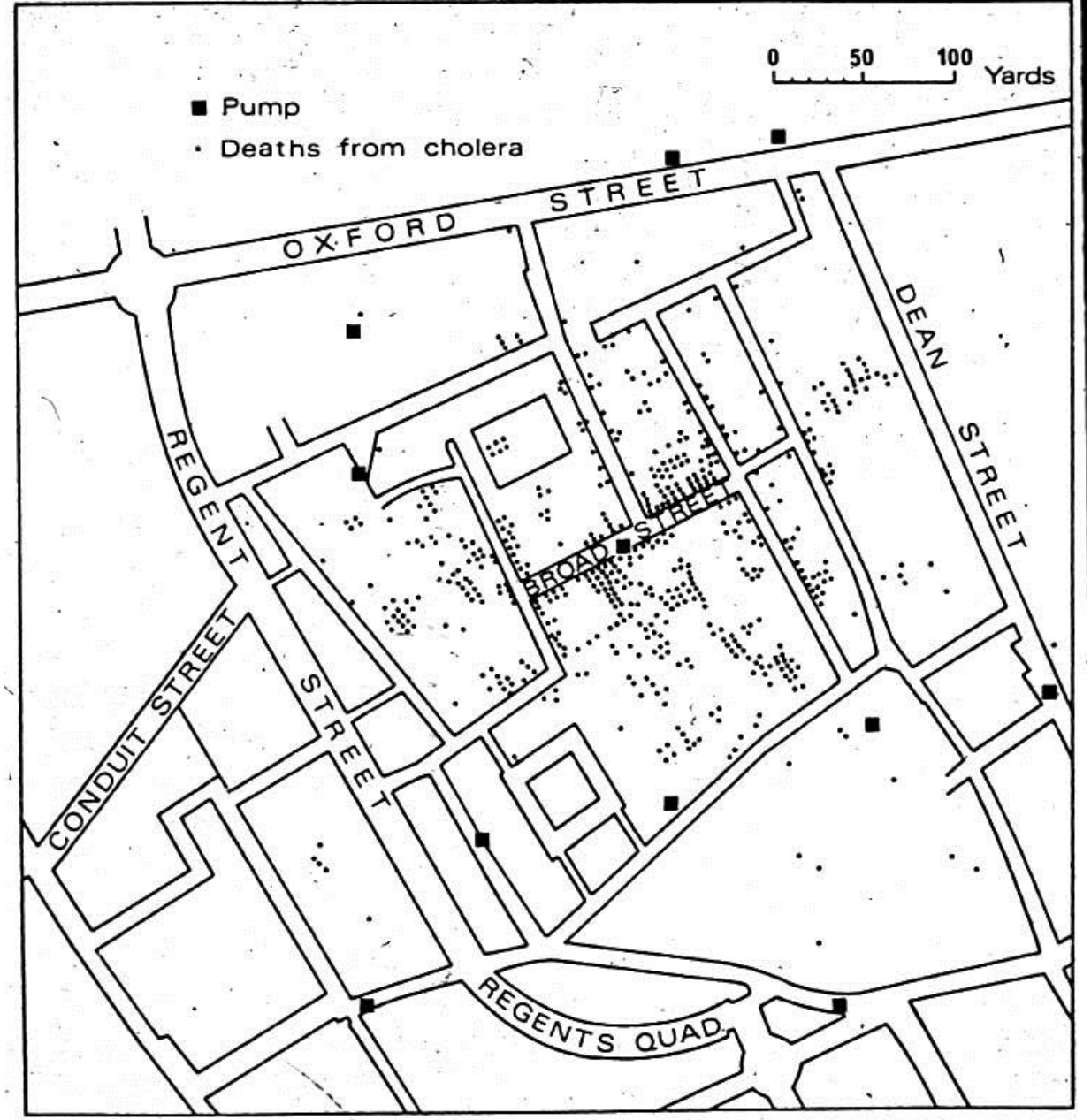
Mapping Disease – A long history

- First case of geography and health: Dr John Snow (‘*the father of epidemiology’*)

First Case



- Cholera epidemics in England
  - 1831-32: 22,000 deaths
  - 1848-49: 52,000 deaths
- Confusion about cause (miasmas [bad air] vs germs)
- Enter – *John Snow!*



2. Deaths from cholera in the Soho district of London, September 1854. Dr John Snow's celebrated map, which established the connection between the cholera outbreak and a single polluted water pump in Broad Street. This emphasized the importance of supplying pure water to the inhabitants of the growing cities of Britain.

Broad St, Soho, London- 1854

Mapped cholera cases & water pumps – suspected Broad St pump as cause

Recommended removal of pump handle & viola, outbreak subsided!

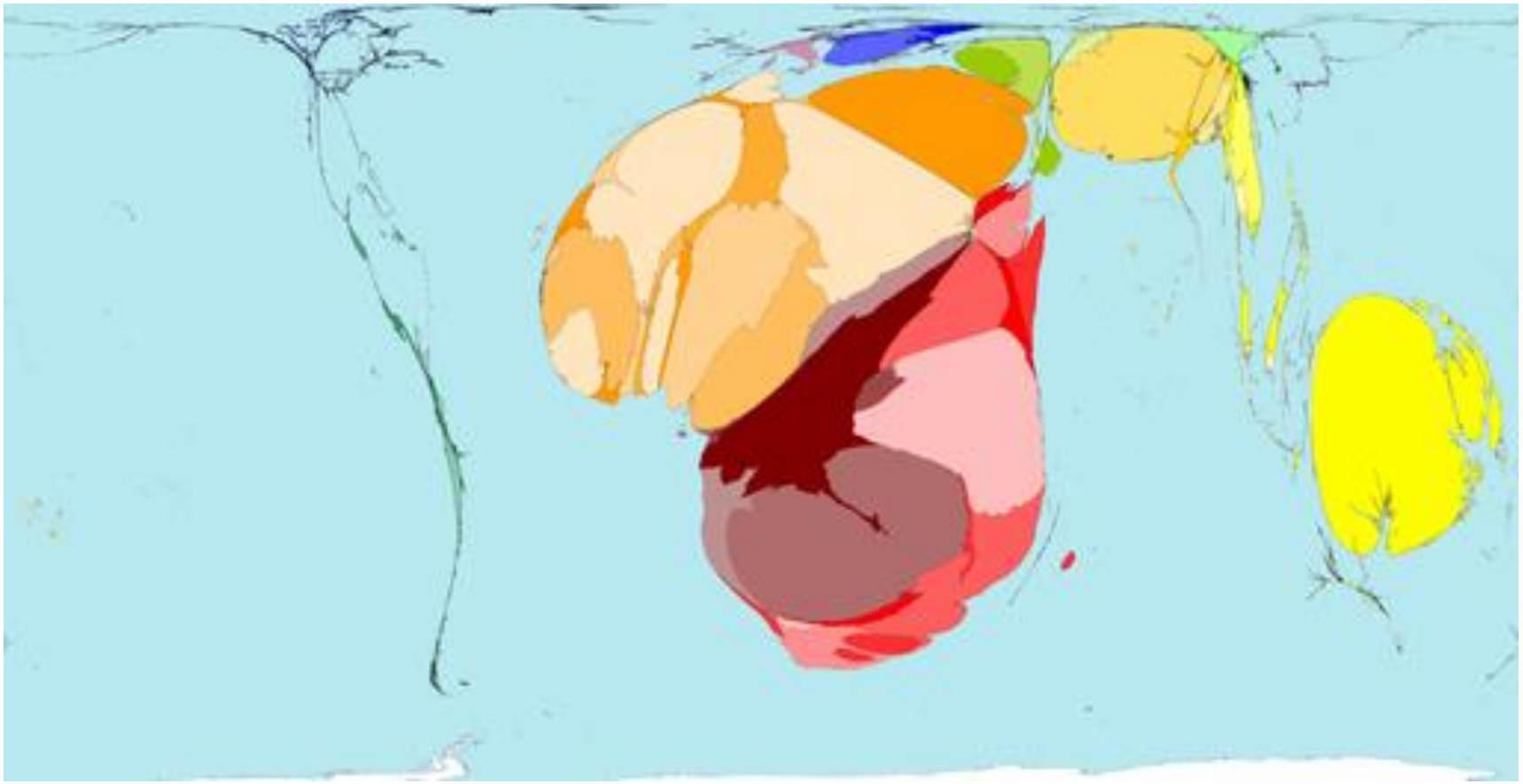
John Snow

- 1854 Epidemic: ***"Grand Experiment"*** - Personal survey of cholera victims & what water companies they got their water from

John Snow

- 1854 Epidemic: ***"Grand Experiment"*** - Personal survey of cholera victims & what water companies they got their water from
  - Southwark & Vauxhall Water Co **(315 deaths per 10,000)**
  - Lambeth Water Co (upstream) **(37 deaths per 10,000)**
    - **8.5 x risk with dirty water**
- Raised awareness of environmental risks
  - Led to UK sanitary reform
  - Final UK epidemic 1866: only 2,200 cases
  - Vibrio Cholera, organism that causes cholera was discovered 25 years after Snow died

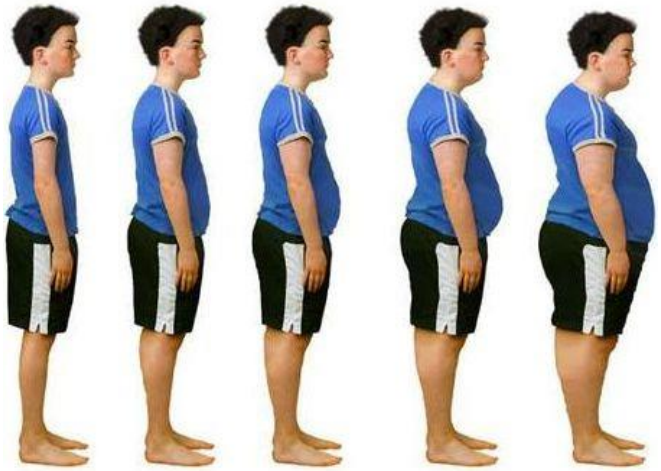
Cholera Deaths



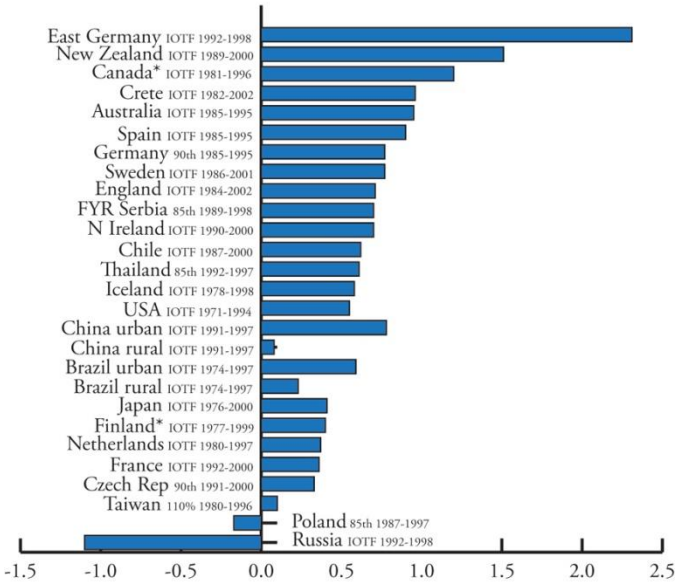
http://www.worldmapper.org/posters/worldmapper_map232_ver5.pdf

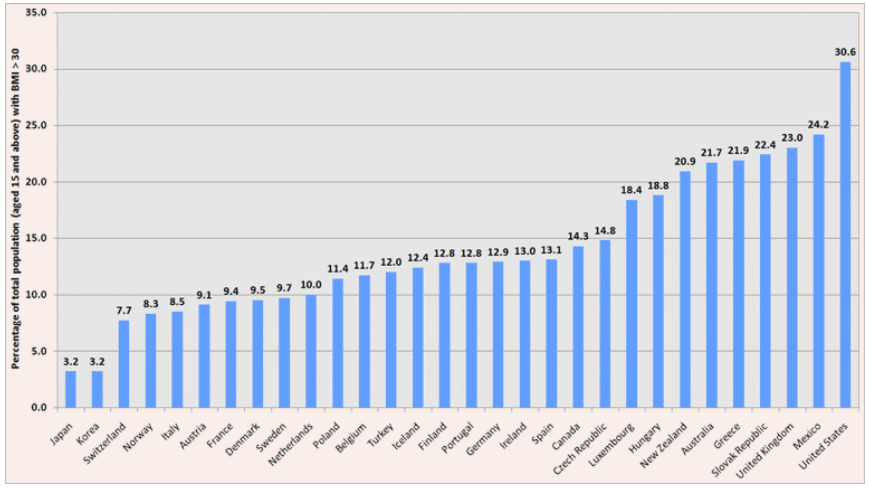
WORLDMAPPER The world as you've never seen it before

A worldwide epidemic of obesity



Annualized Change in Prevalence of Overweight and Obesity in School-age Children in Survey since 1970 (percentage points)





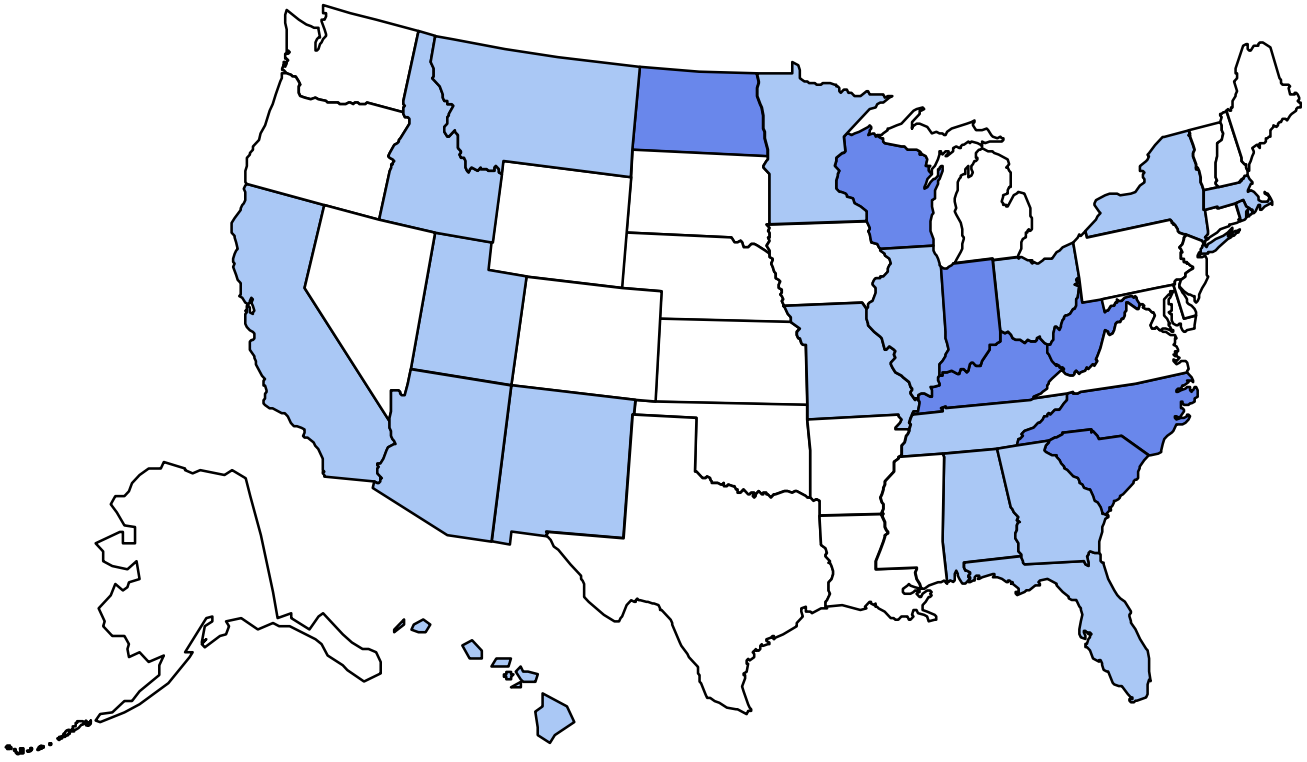
Causes of obesity

- Genetics
- Individual behaviour: gluttony or sloth
- Obesogenic environments

Obesity Trends* Among U.S. Adults

BRFSS, 1986

(*BMI ≥30, or ~ 30 lbs. overweight for 5’ 4” person)



Obesity Trends* Among U.S. Adults

BRFSS, 1988

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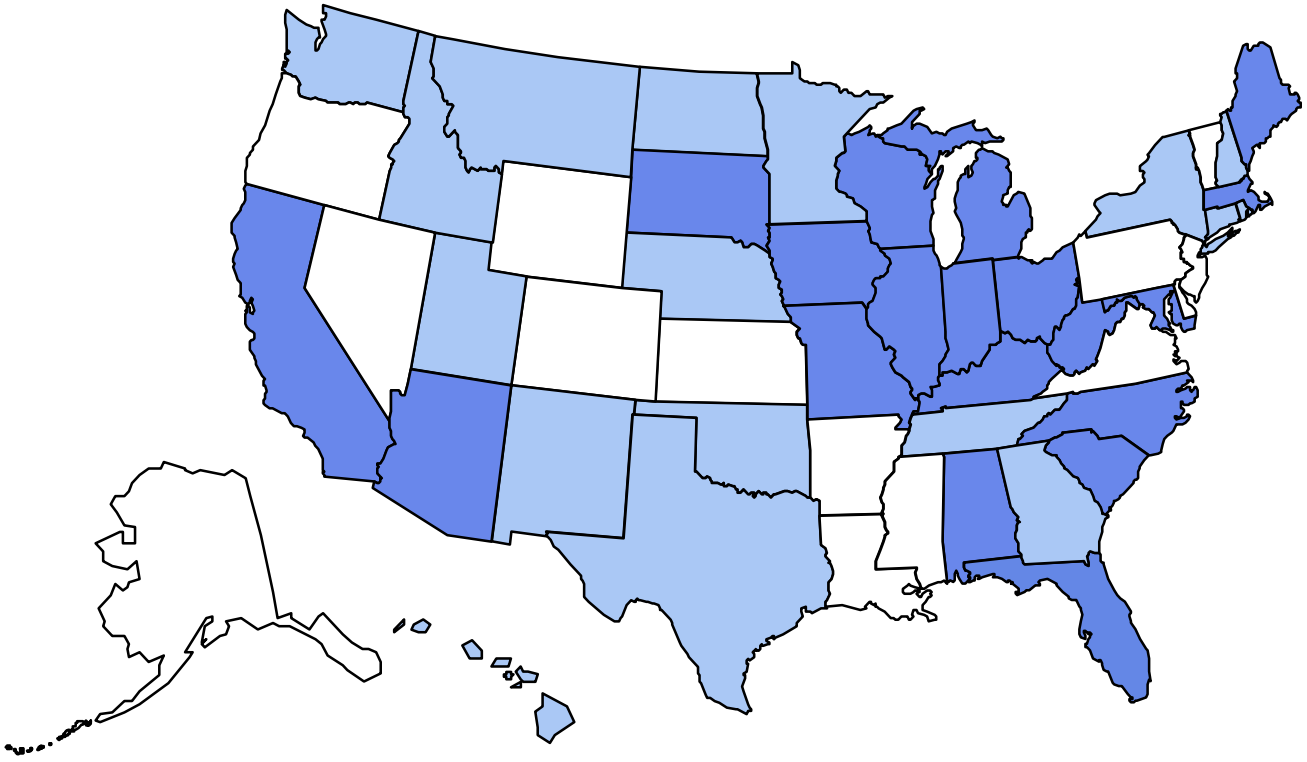

Obesity Trends* Among U.S. Adults

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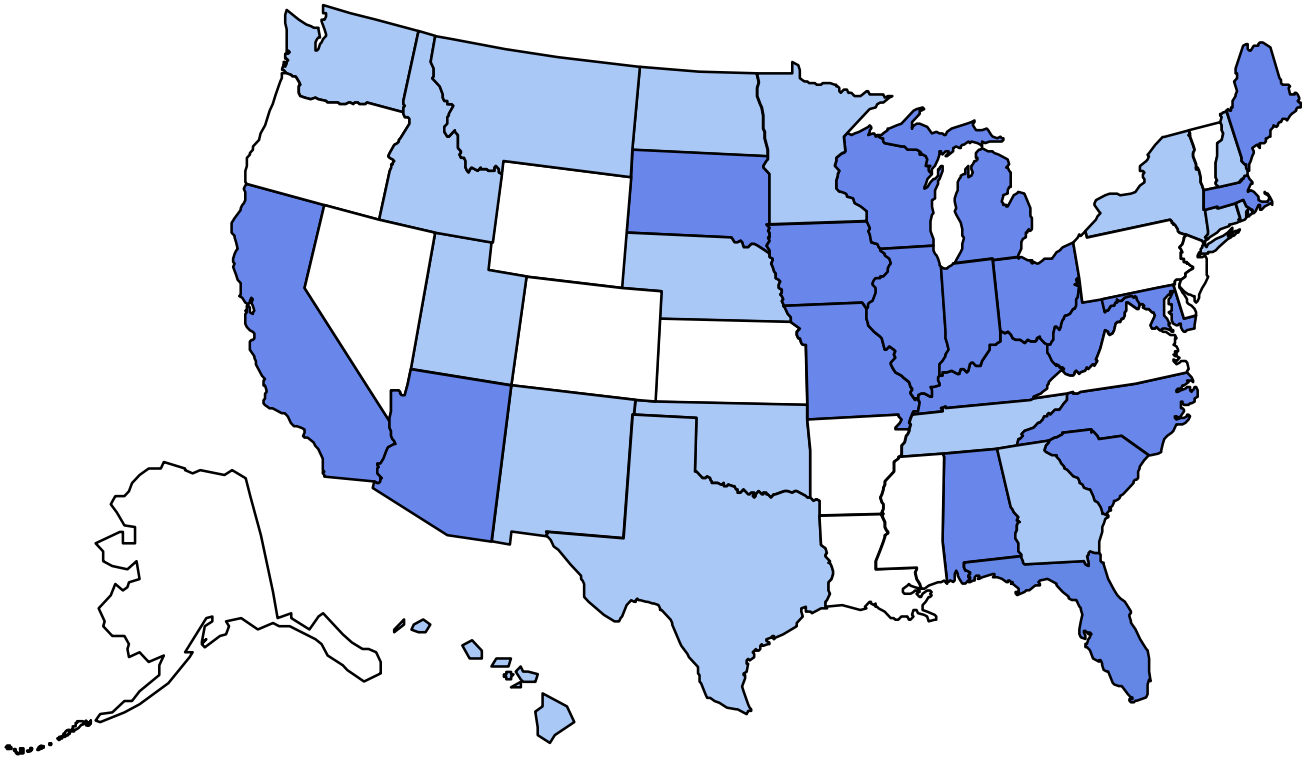
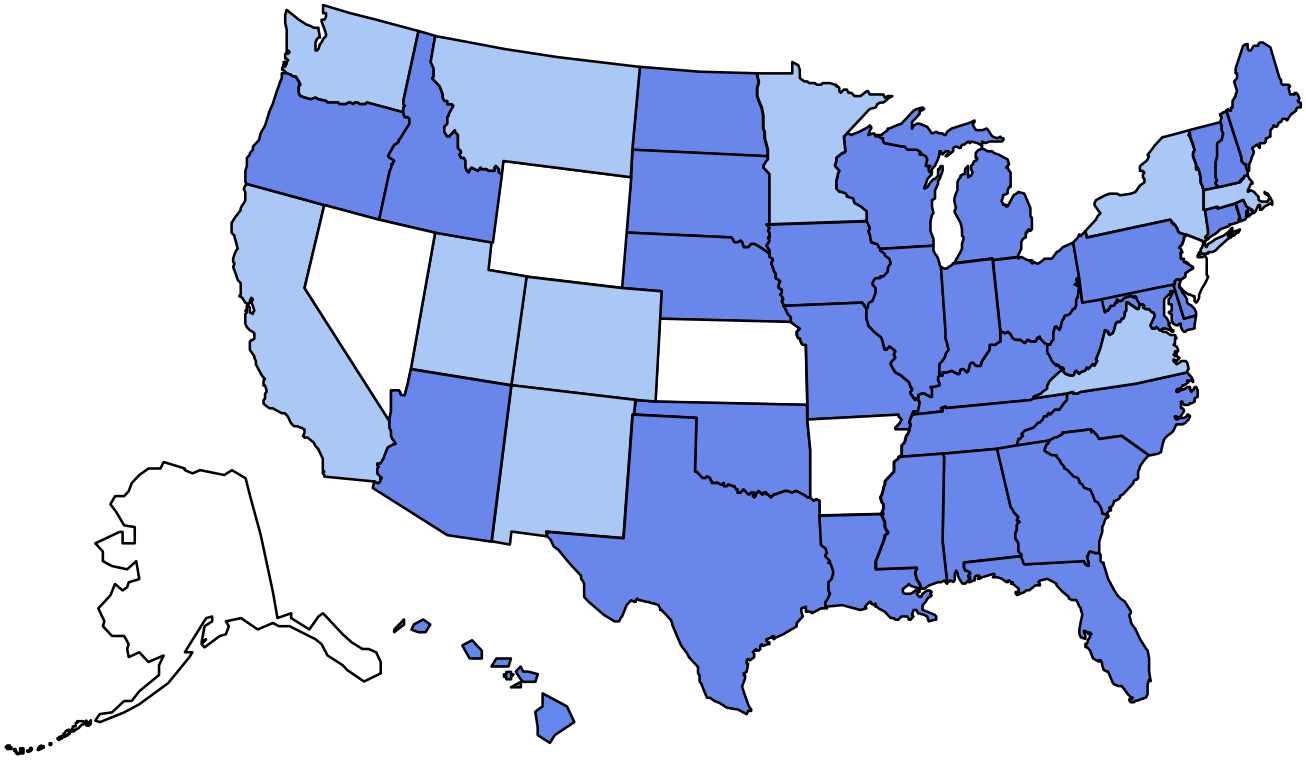


Obesity Trends* Among U.S. Adults

BRFSS, 1990

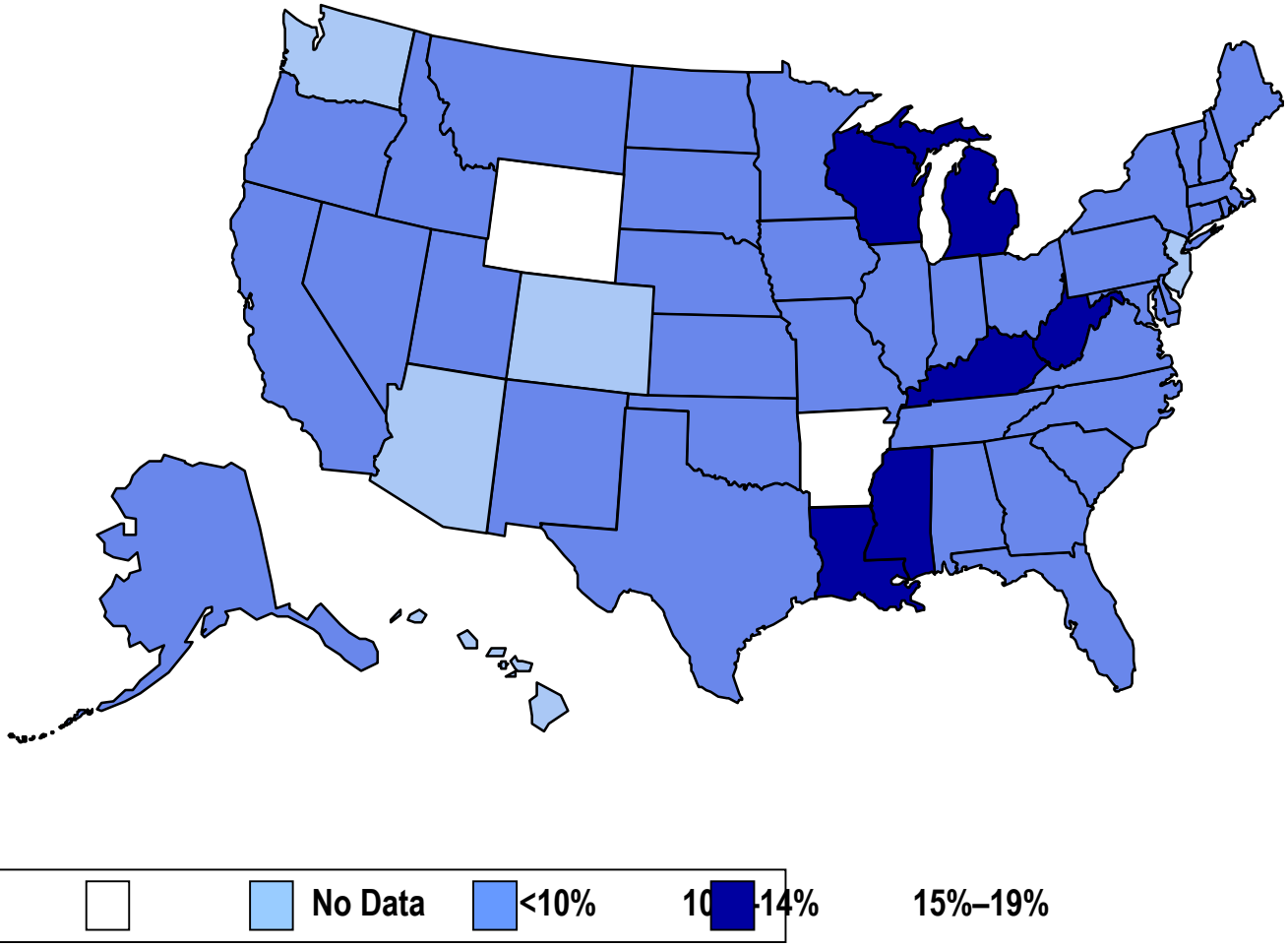
(*BMI ≥30, or ~ 30 lbs. overweight for 5’ 4” person)



Obesity Trends* Among U.S. Adults

BRFSS, 1992

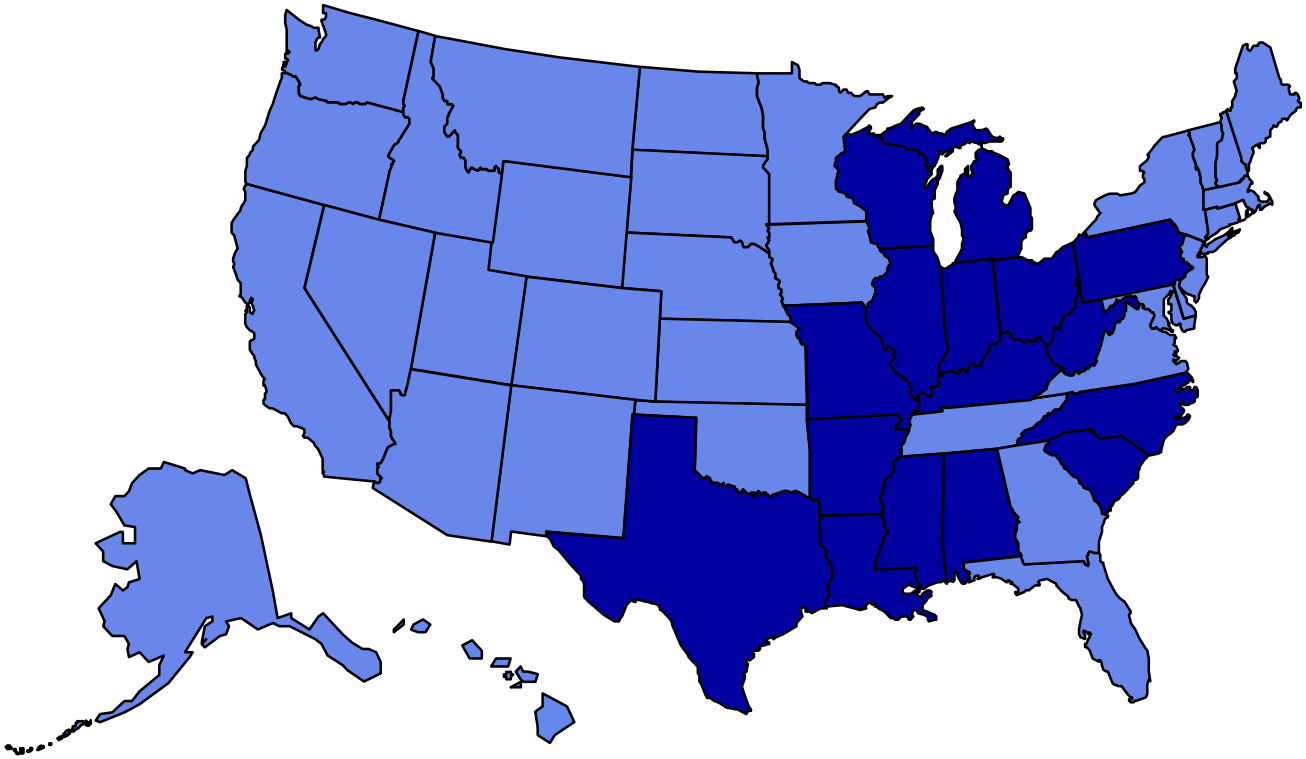
(*BMI ≥30, or ~ 30 lbs. overweight for 5’ 4” person)



Obesity Trends* Among U.S. Adults

BRFSS, 1994

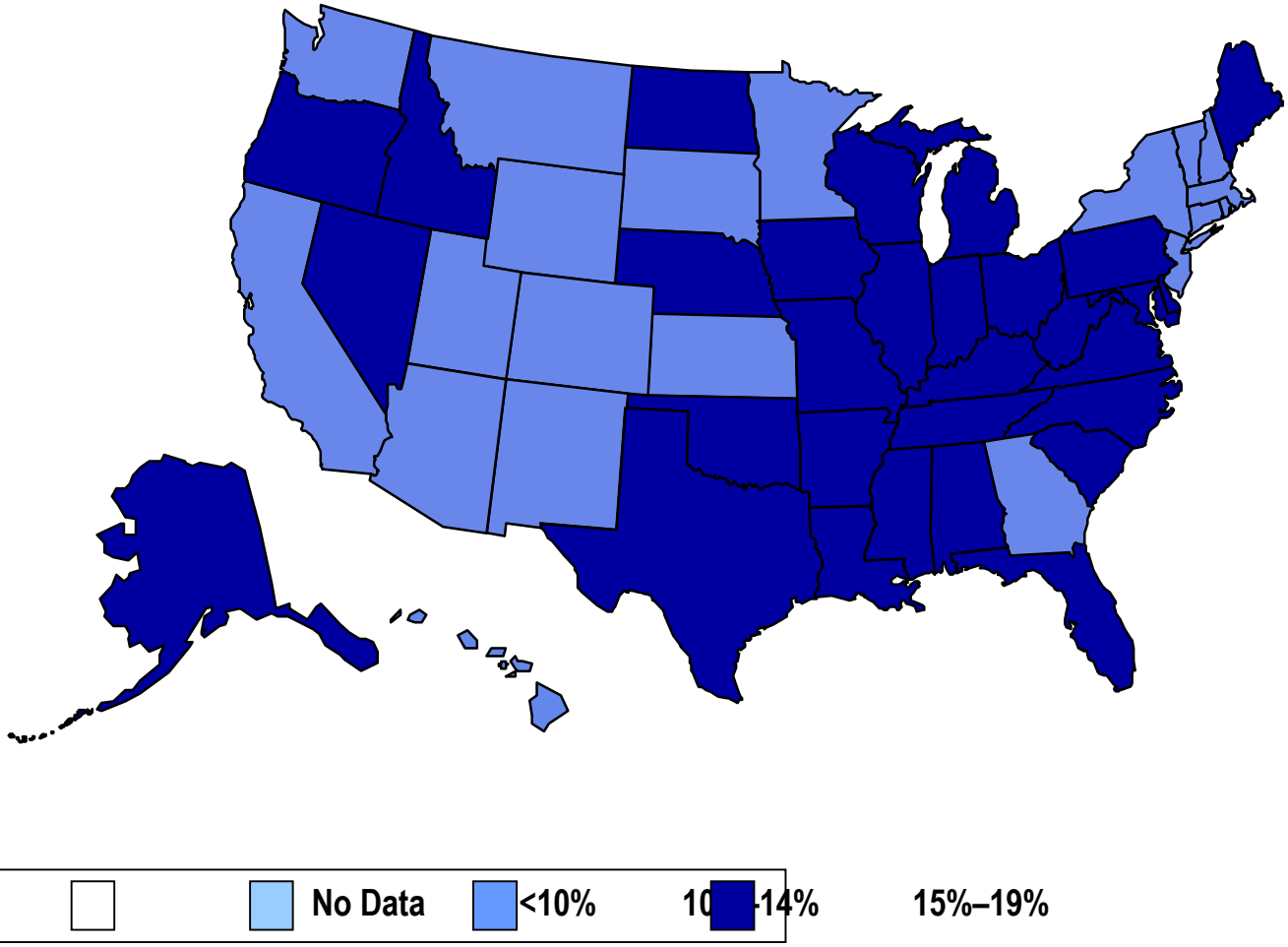
(*BMI ≥30, or ~ 30 lbs. overweight for 5’ 4” person)



Obesity Trends* Among U.S. Adults

BRFSS, 1996

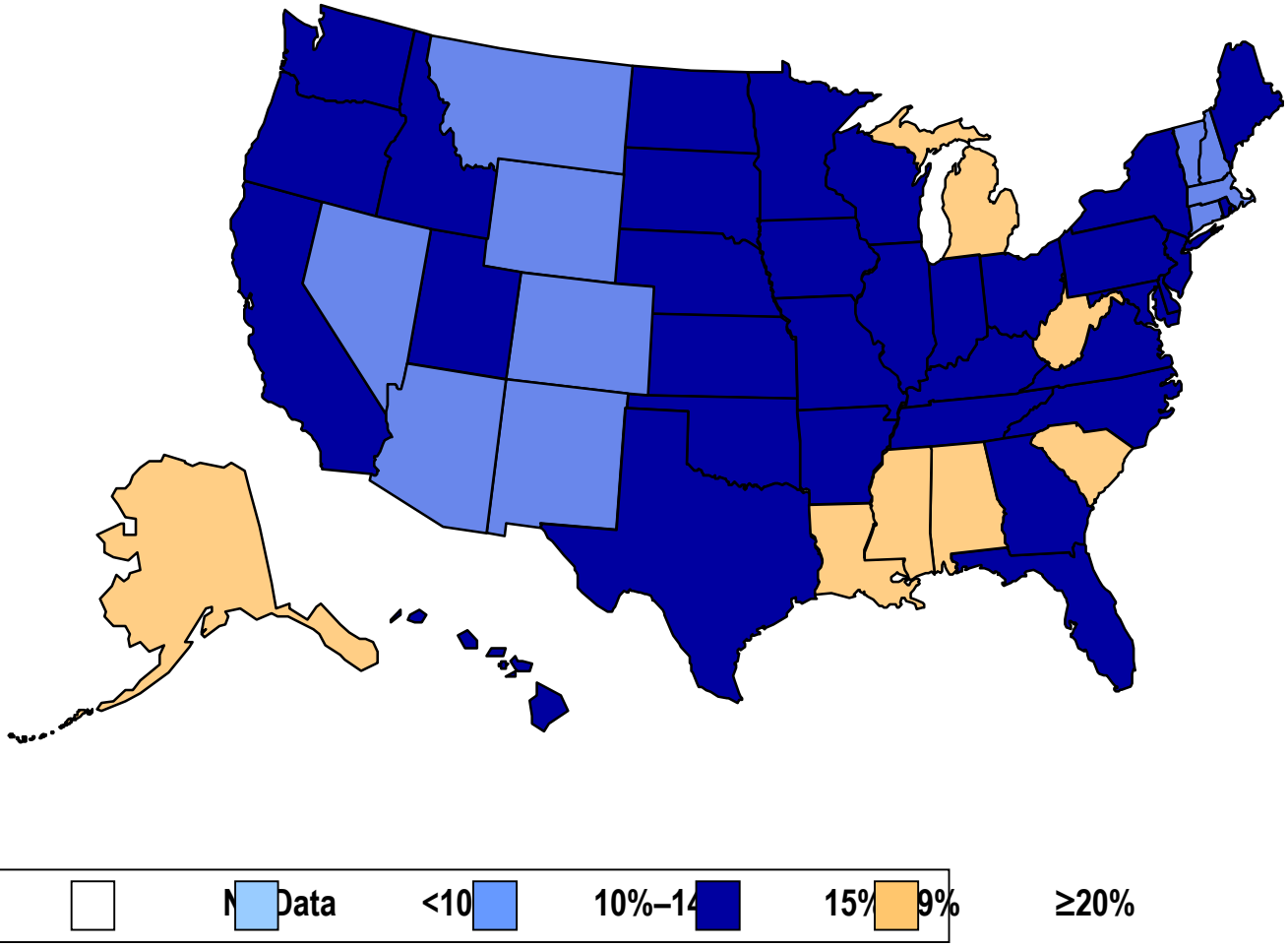
(*BMI ≥30, or ~ 30 lbs. overweight for 5’ 4” person)



Obesity Trends* Among U.S. Adults

BRFSS, 1998

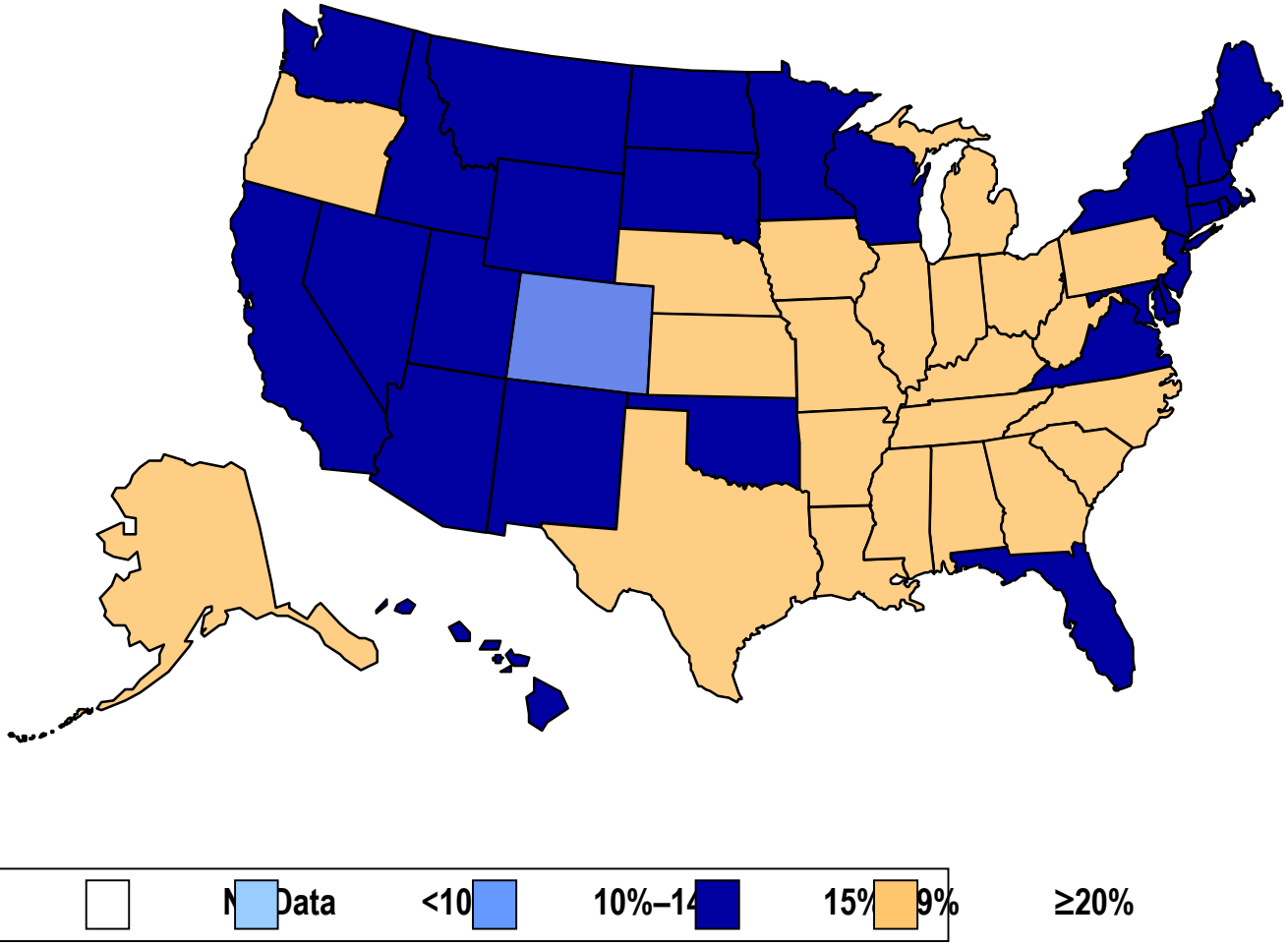
(*BMI ≥30, or ~ 30 lbs. overweight for 5’ 4” person)



Obesity Trends* Among U.S. Adults

BRFSS, 2000

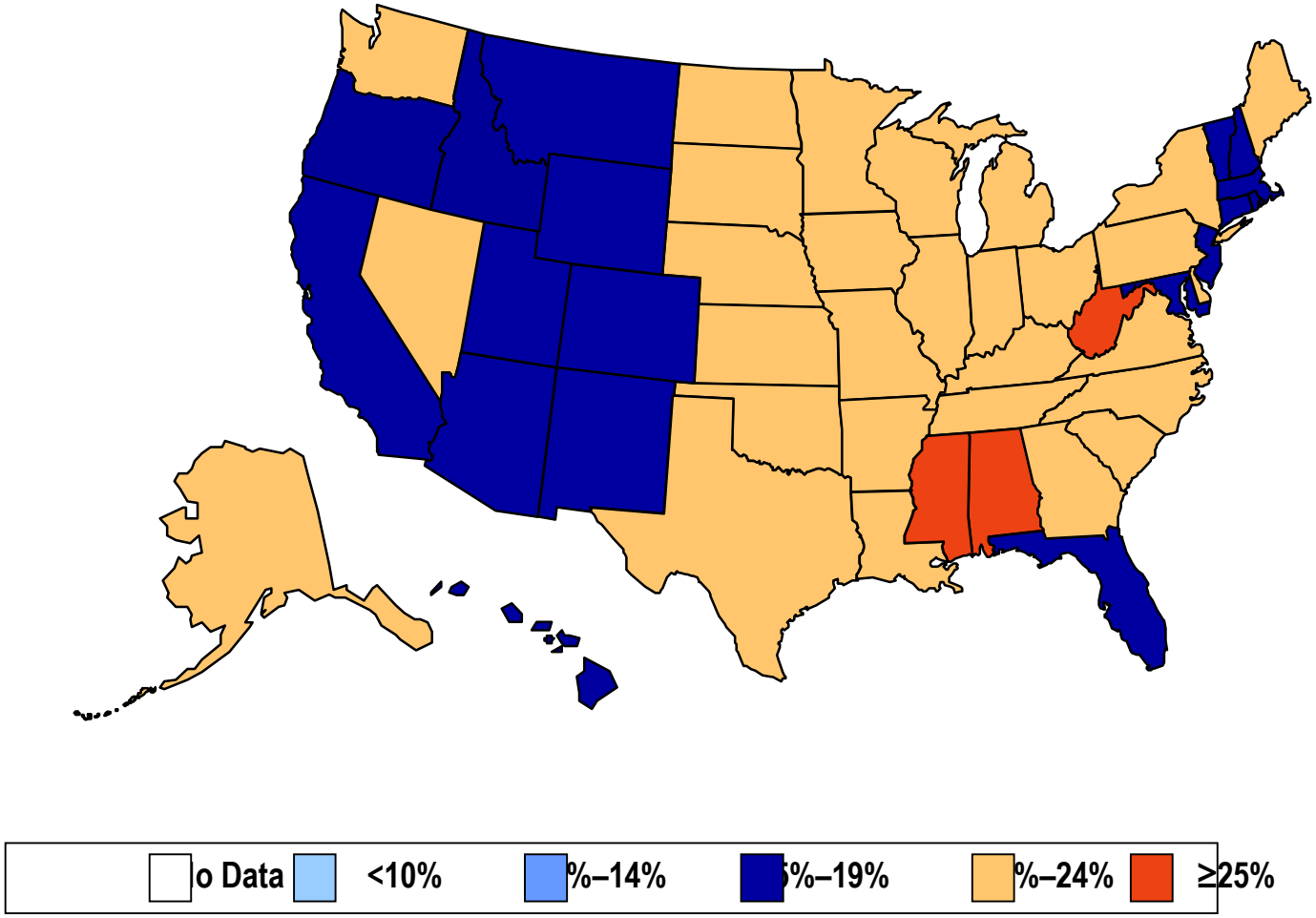
(*BMI ≥30, or ~ 30 lbs. overweight for 5’ 4” person)



Obesity Trends* Among U.S. Adults

BRFSS, 2002

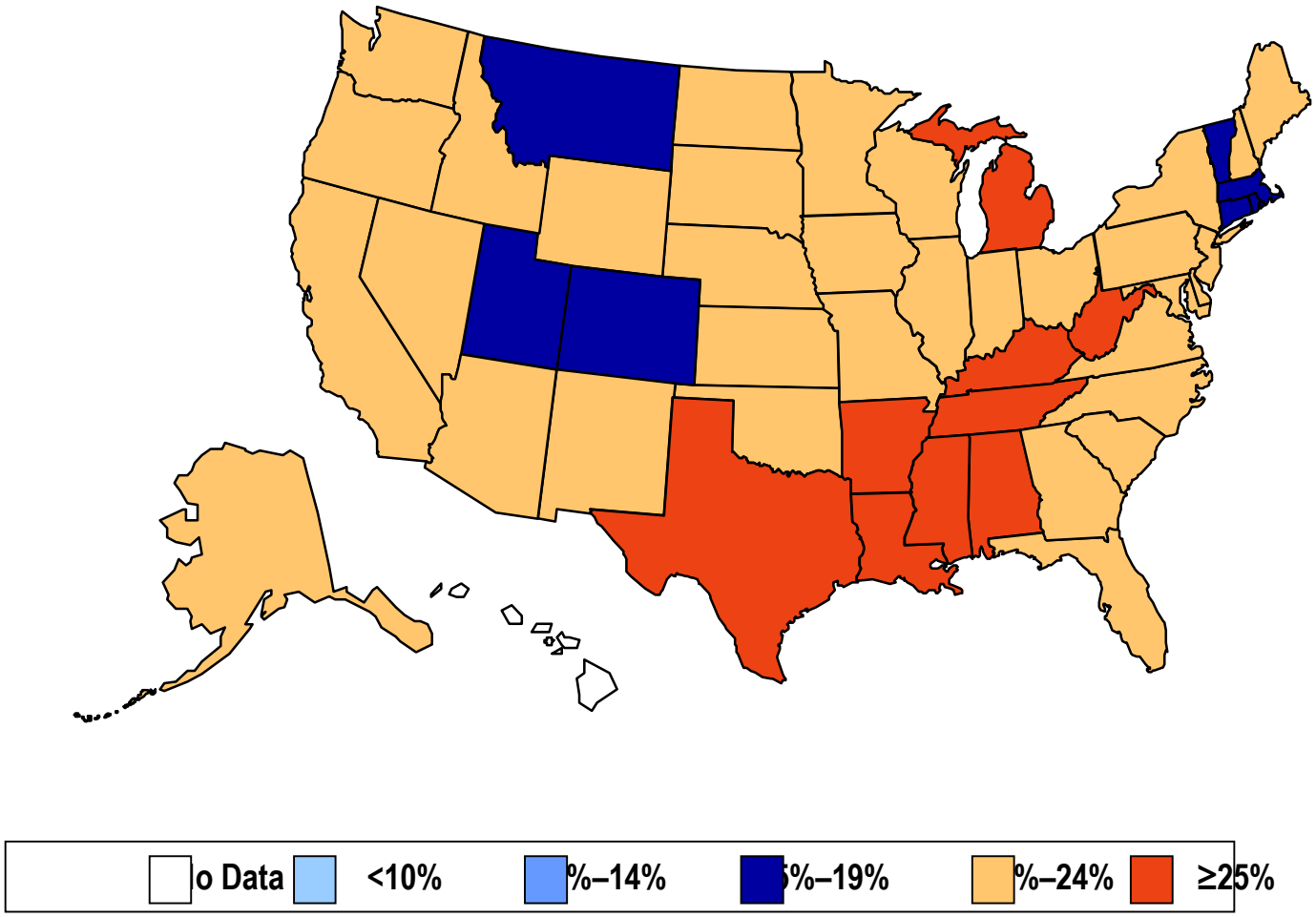
(*BMI ≥30, or ~ 30 lbs. overweight for 5’ 4” person)



Obesity Trends* Among U.S. Adults

BRFSS, 2004

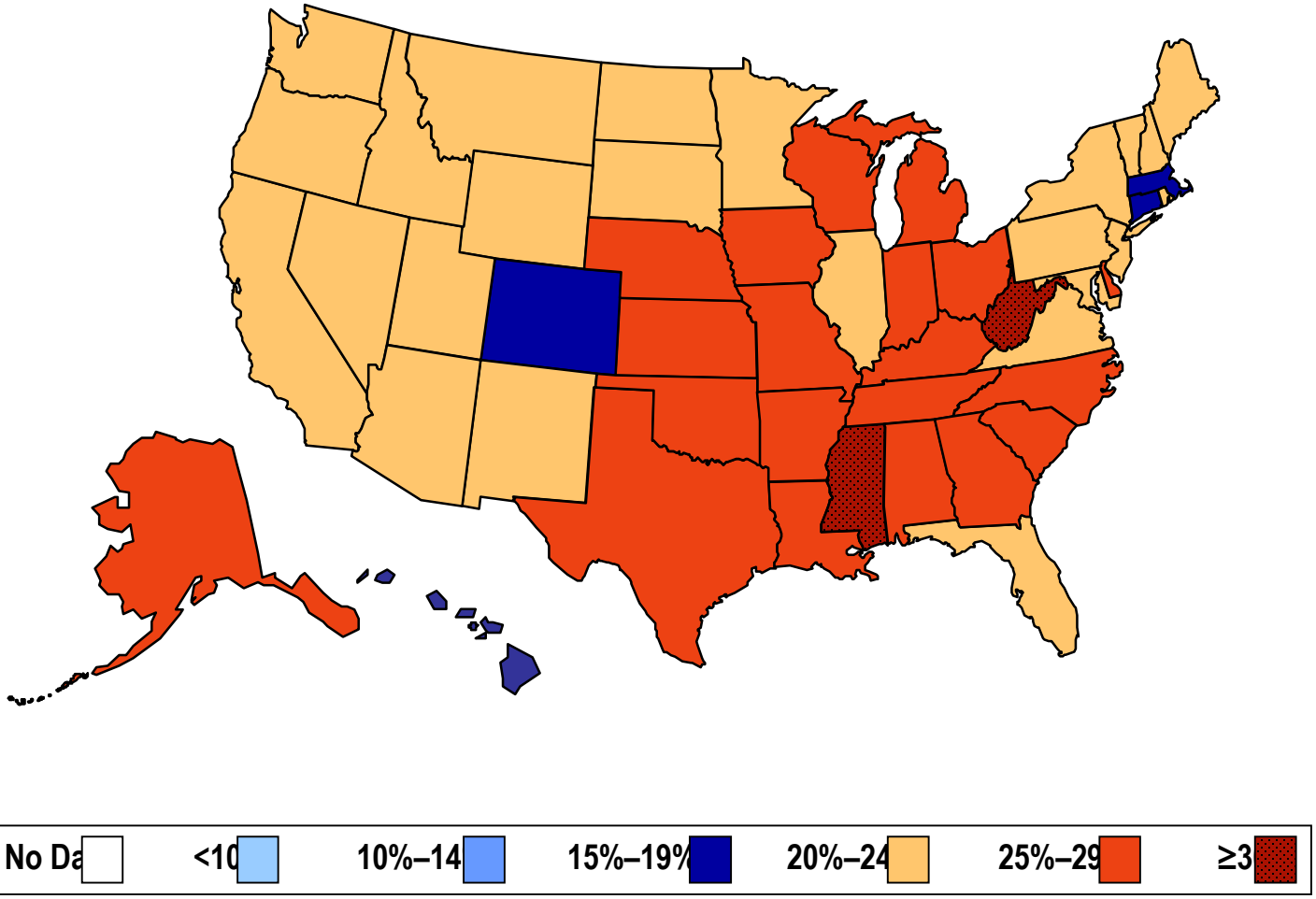
(*BMI ≥30, or ~ 30 lbs. overweight for 5’ 4” person)



Obesity Trends* Among U.S. Adults

BRFSS, 2006

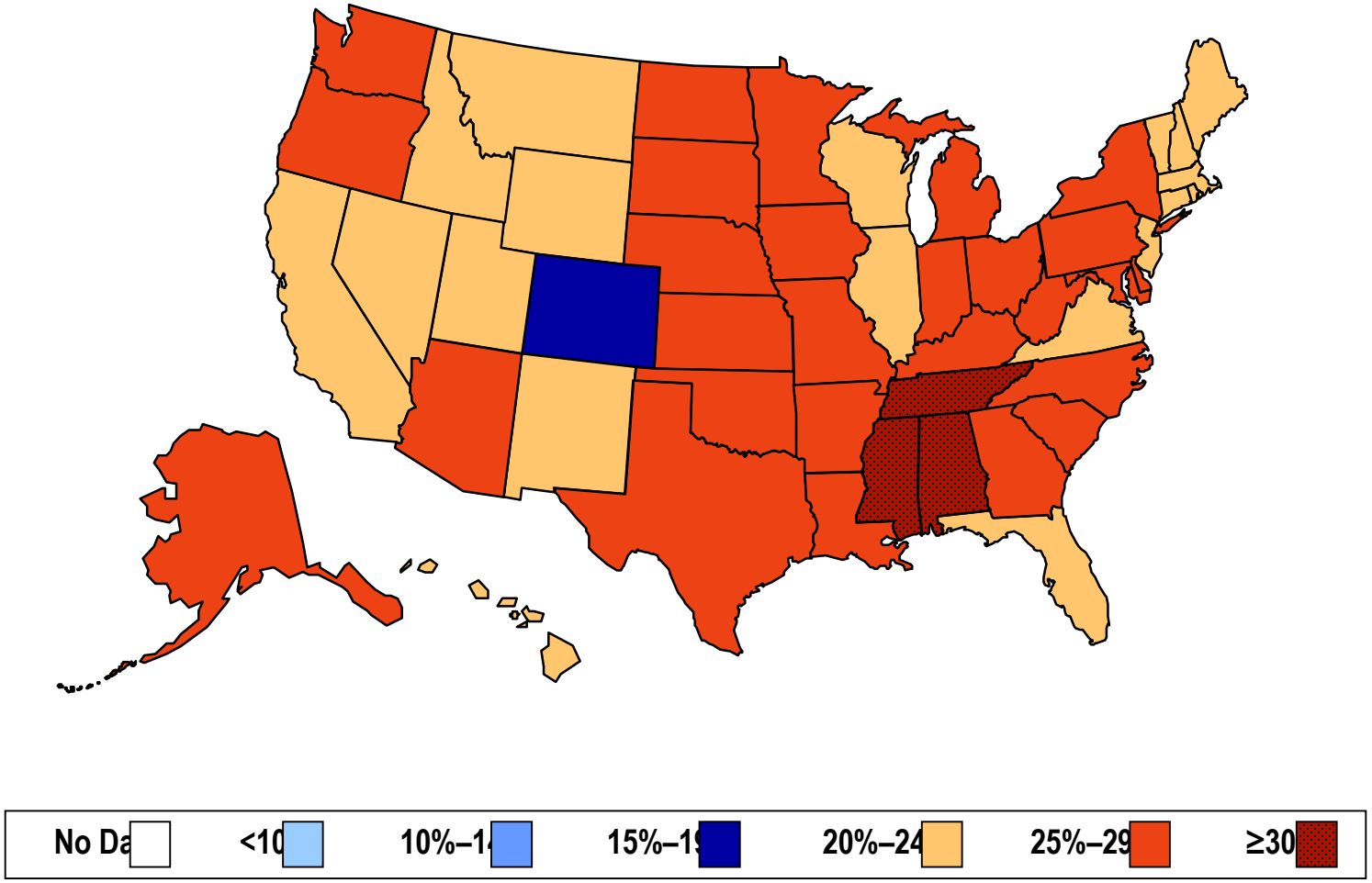
(*BMI ≥30, or ~ 30 lbs. overweight for 5’ 4” person)



Obesity Trends* Among U.S. Adults

BRFSS, 2007

(*BMI ≥30, or ~ 30 lbs. overweight for 5’ 4” person)



So much more

- Health geography = the application of geographical approaches to the study of health, disease & health care
- Geographic Information Systems (GIS)

Geographic Information Systems (GIS)

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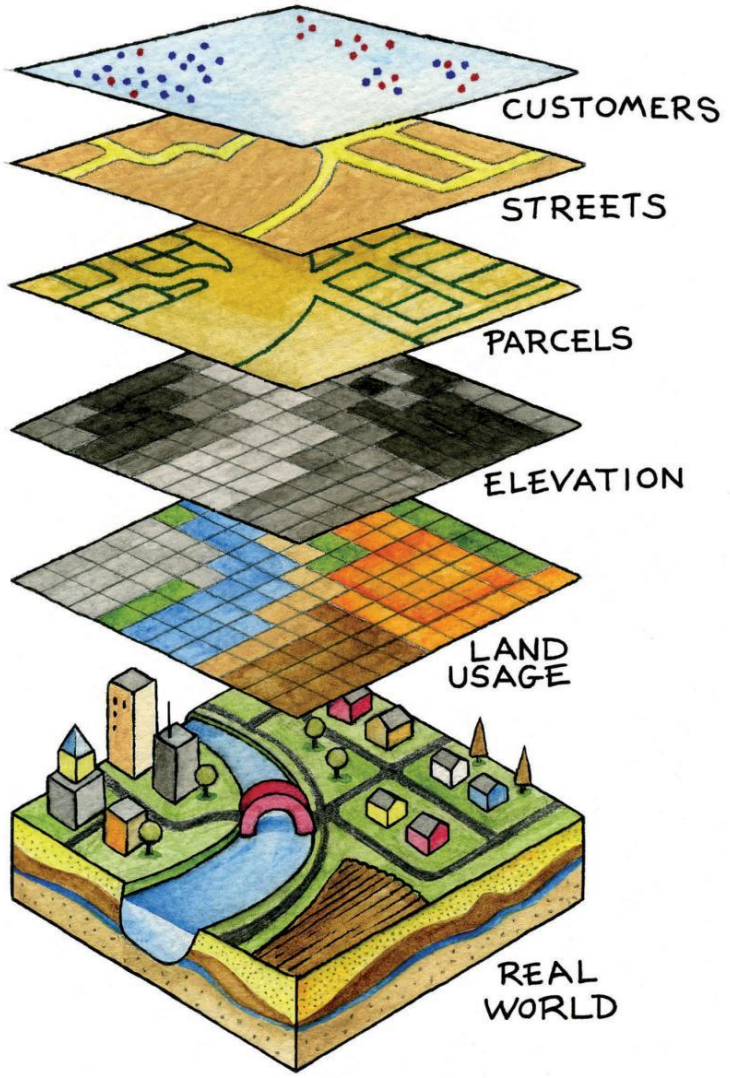
What is it?

a technology that is used to view and analyse data from a geographic perspective



GeoScience

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GIScience

the combination of GIS and associated spatial statistics and spatial thinking applied to the analysis of geographically distributed data

Uses of GIS

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- Planning
- Power
- Conservation
- Forestry
- Crime mapping
- Biosecurity
- Sport (tracking athletes)
- Fire, police & ambulance
- History
- Indigenous knowledge
- Community engagement
- Transport
- Waste and stormwater
- Hydrology
- Contaminated land
- Emergency management
- Demography
- Resource management
- Infrastructure
- Health

www.linz.govt.nz

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The power of where

Location has the power to unlock the potential of so much other information. It can drive better decision making, benefiting our economy, environment and communities.

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Information for surveyors

Rules, standards and guidelines for surveyors to successfully carry out land transactions.

Information for lawyers

Property titles registration information for lawyers, conveyancers and other property professionals.

Māori and iwi development

Working for the effective use of Māori land and other natural resources in Aotearoa.

cera.govt.nz/maps

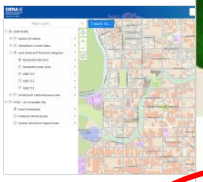
Te Mana Haumanu ki Waitaha

Home | My Property | Recovery Strategy

- Support and assistance
- Property information
- CBD Rebuild Zone
- About CERA
- News
- Questions and answers
- Demolitions
- Library
  - Annual Report
  - Better Business Cases
  - Cabinet papers
  - The Cathedral File
  - Chief Executive expenses
  - Economic indicators
  - Government response to draft Central City Plan
  - Legislation
  - Maps
    - CERA map viewer
    - Planning and Community Toolset
  - Photos
  - Science and data
  - Statement of Intent
  - Video gallery
  - Wellbeing Survey
  - Youth Wellbeing Survey

CERA online maps

The CERA Map

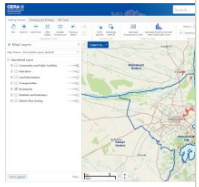


- The CERA Map »
- More information about the CERA map viewer

This easy-to-use map viewer will run on any device. It contains the following layers of information:

- Land zone status and technical categories
- Demolition status and section 45 notices
- Prioritised routes for different travel modes from the Accessible City chapter of the Recovery Plan
- Aerial images of the city over time (including aerial pre-September 2010)
- Central City (CCDU) Blueprint and Anchor Projects.

Planning and Community Toolset (PACT)



A multi-layered desktop tool showing the changes across greater Christchurch providing a raft of information including land use and zoning, transport routes, and population figures to help with future planning in the region.

The aim is to give community groups and organisations easy access to information that will help them plan their own future facilities.

- PACT map viewer »
- More information about the Planning and Community Toolset (PACT)

Christchurch Central: Anchor Projects and Private Sector Prog

This map highlights the Christchurch Central Development Unit (CCDU) Anchor Projects cost sharing split between Crown and Local Government, and features private sector recovery development happening within the

www.doc.govt.nz/about-doc/role/maps-and-geospatial-services/

Department of Conservation
Te Papa Atawbai

Search

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Role

You are here: About DOC > Role > Maps and geospatial services

Maps and geospatial services

In this section:

- Maps and geospatial services
- Geospatial data - Terms and conditions
- Natural Resource Group GIS network
- Download DOC GeoSpatial Data

DOC is one of New Zealand's leading organisations in geospatial technology. Geospatial data is location-based data, and GIS (Geographic Information Systems) is a tool to manage, store, view and edit this data.

DOC has developed for public use, the following mapping tools to view and access DOC's spatial data.

DOC Maps

DOC Maps is designed for a broad audience including scientists, planners, Governmental agencies and teachers. It displays information on:

- DOC land, activities and facilities
- general land classifications
- property and cadastral information

ecan.govt.nz/pages/home.aspx

Related websites | Metro Info | Civil Defence

Publications | Quick Answers | A-Z Index | Glossary | Sitemap

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

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Search the Environment Canterbury website.. SEARCH

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GET IT DONE ONLINE

- Contact us
- Work for us
- Consent search
- GIS mapping
- River flows (Latest)
- Irrigation restrictions

Jobs

www.seek.co.nz/jobs/#dateRange=999&workType=0&industry=&occupation=&graduateSearch=false&salaryFror

Active filters: GIS

Date Listed

Keywords

Location

Classification

Salary

Work Type

Clear all

Sort by date

Junior CAD Consultant (Abbotsford, VIC)
Coffey International Limited
- Pivotal support role to the Spatial team
- Global professional services consultancy firm
- Abbotsford, Victoria

Real potential is uncovered only when you scratch beneath the surface

Engineering > Environmental Engineering
Add to shortlist

2:00 PM
Melbourne

Assets Engineering Officer
North Sydney Council

We are seeking a suitably qualified individual to effectively and efficiently assist in the management of Council's assets.

Government & Defence > Government - Local
Add to shortlist

1:38 PM
From $73548-$87822pa + super + 3.5% CLA + car
Sydney
↳ North Shore & Northern Beaches

GIS Analyst
AECOM
- Join a global Fortune 500 organisation
- Sydney CBD location
- Supportive environment

Excellent opportunity for a Professional Spatial Information Specialist to join our Geographic Information Systems team.

Information & Communication Technology > Other
Add to shortlist

1:05 PM
Sydney
↳ CBD, Inner West & Eastern Suburbs

Aborists - Edinburgh
Transfield Services (Aust) Pty Ltd

We are seeking an Arborist to conduct all tree inspections, mapping, reporting, trimming and felling of trees on the Defence sites.

Trades & Services > Gardening & Landscaping
Add to shortlist

11:17 AM
Adelaide

Business Analyst | GIS | CBD location
Talent International – SARA Winner Large Recruitment Agency 2014 - SEEK
- Supportive work environment

Mon 24 Nov
Melbourne
↳ CBD & Inner Suburbs

www.seek.co.nz/jobs/in-new-zealand/#dateRange=999&workType=0&industry=&occupation=&graduateSea

Active filters: GIS | All New Zealand

Date Listed

Sort by date

Data Analyst
Hudson New Zealand
- Permanent Role
- SQL focus
- CBD Location

Pemanent Data Intelligence Analyst, SQL Databases, knowledge of web applications and **GIS**, CBD location

Information & Communication Technology > Database Development & Administration
Add to shortlist

Mon 24 Nov
Wellington
↳ Wellington Central

Spatial Intelligence Analyst
Hudson New Zealand
- Permanent Role
- CBD Location
- Enterprise **GIS** environment

Permanent Spatial Intelligence Analyst, **GIS**, ESRI and Integraph, enterprise analysis and modelling, some knowledge of SQL a bonus

Information & Communication Technology > Business/Systems Analysts
Add to shortlist

Mon 24 Nov
Wellington
↳ Wellington Central

SPATIAL INTELLIGENCE ANALYST
New Zealand Fire Service

Exciting role within the NZ Fire Service, opportunity to utilise your knowledge within a supportive team and make a real difference to the business!

Information & Communication Technology > Business/Systems Analysts
Add to shortlist

Fri 21 Nov
Wellington
↳ Wellington Central

14/1175 - Senior Geospatial Consultant
Statistics New Zealand
- Christchurch or Wellington - Permanent
- Flexible working hours
- Internal & external training programmes on offer

A key part of this role involves engaging with internal stakeholders to ensure statistical requirements and geospatial solutions are meeting needs.

Government & Defence > Government
Add to shortlist

Fri 21 Nov
Canterbury
↳ Christchurch

www.careers.govt.nz/jobs/infrastructure/geospatial-specialist/job-opportunities

careersnz Search... SEARCH My Career Portfolio You are not logged in.

www.computerworld.co.nz/article/453577/spatial_experts_added_immigration_skills_shortage_list/

COMPUTERWORLD

Technology Tools Whitepapers Cloud Mobile Social Data

Spatial experts added to Immigration's skills shortage list

Immigration New Zealand has responded favourably to an industry request to ease a shortage of geospatial knowledge

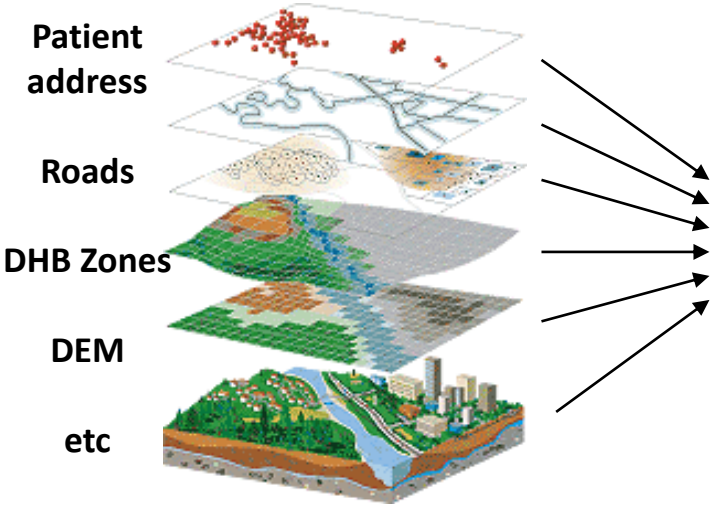
Stephen Bell (Computerworld New Zealand) on 12 February, 2013 20:39

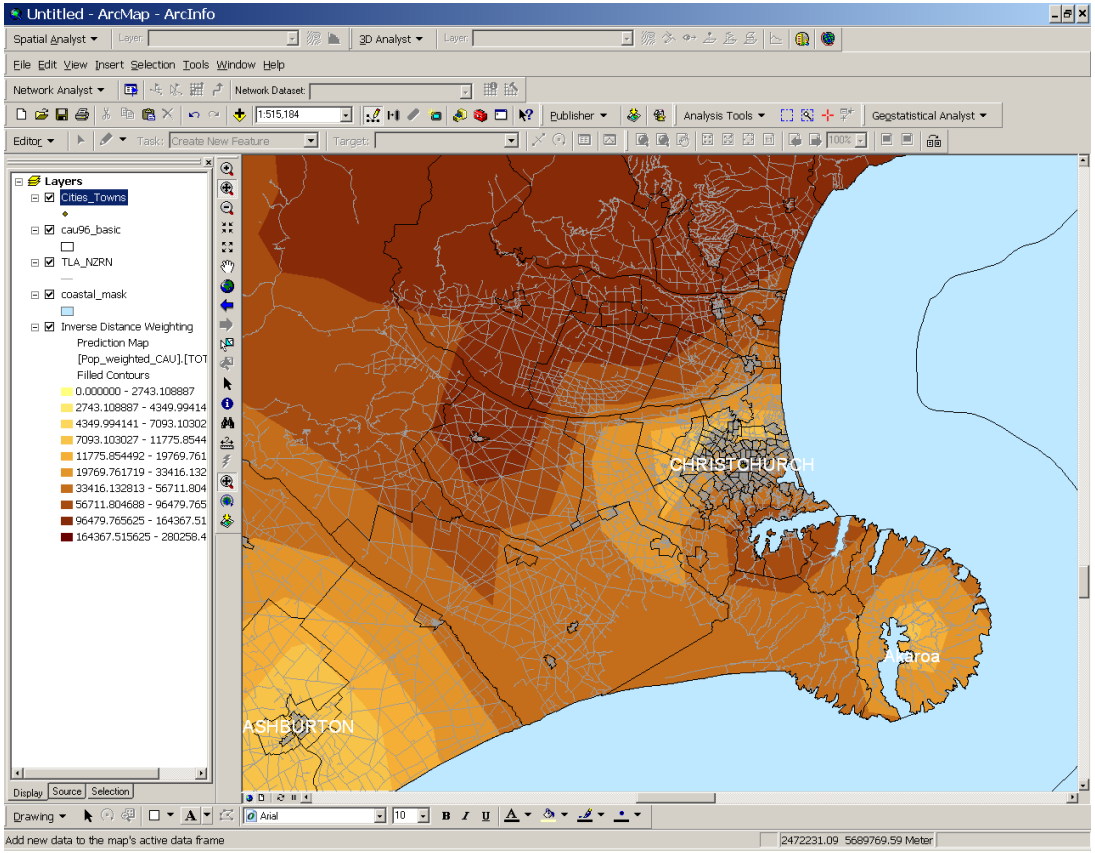
present, the job spatial scientist (geospatial specialist) appears on Immigration New Zealand's Long Term Skill Shortage List. This means the Government is actively encouraging skilled geospatial specialists to come to New Zealand to work.

So much more

- Health geography = the application of geographical approaches to the study of health, disease & health care
- Geographic Information Systems (GIS)
  - Determinants of disease and ill health
  - Health care provision
- Visualisation (mapping etc.)
- Spatial analysis
- Disease clustering
- Modelling
- Mobility and Disease Tracking

- 90% of health data has a spatial component
- Patient residence, medical service location, e.g. Census meshblock (MB) or District Health Board (DHB)
- GIS is "*a technology that is used to view and analyse data from a geographic perspective*"





Mapping

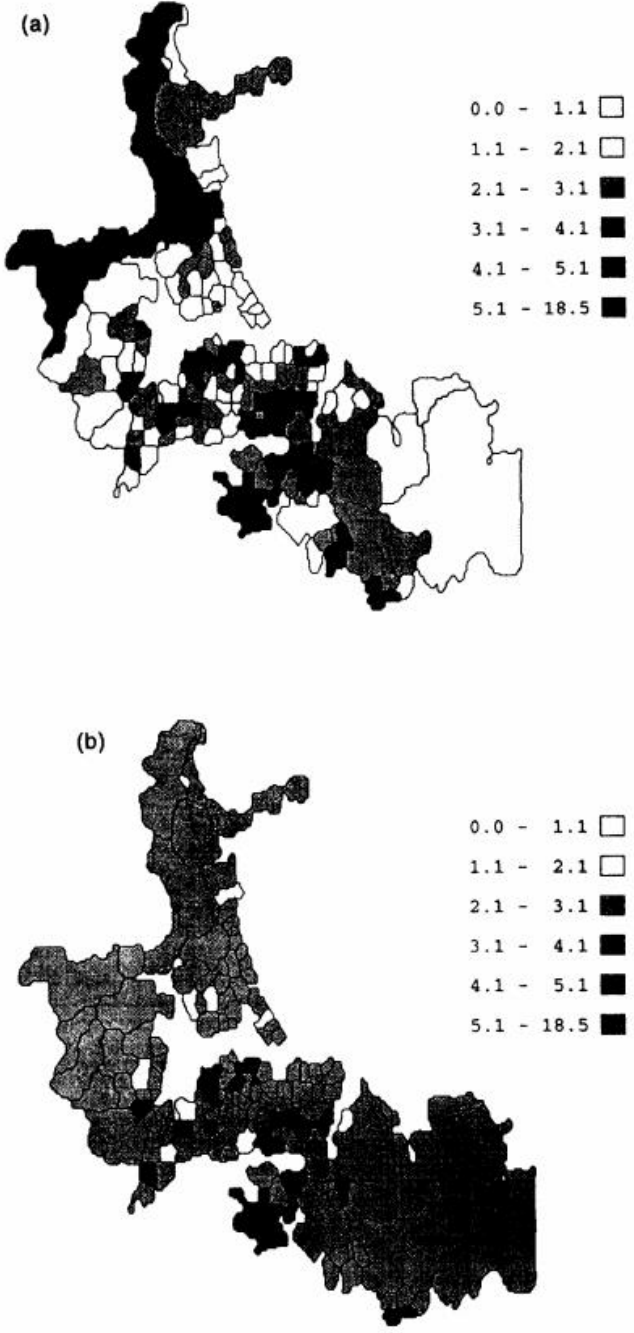
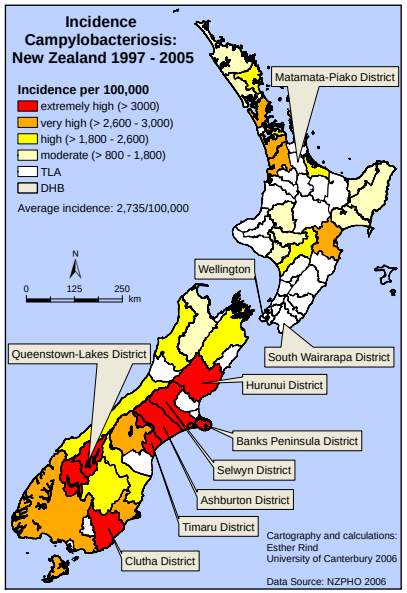


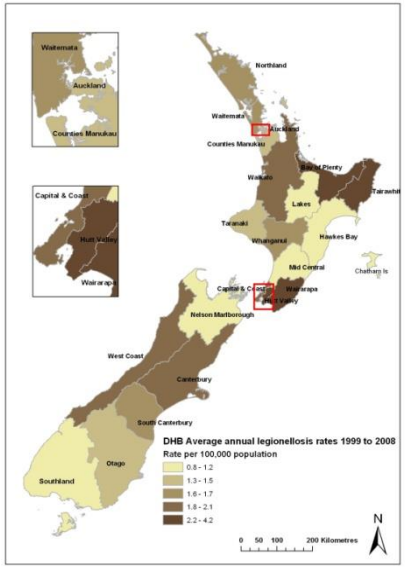
Fig. 5. (a) Child mortality in Auckland, New Zealand (1977 85), expressed as deaths per thousand children per year. (b) Empirical Bayes estimates of child mortality in Auckland.

Marshall RJ, 1991, Mapping disease and mortality rates using empirical Bayes estimators. Appl. Stat. 40, 283. In Gatrell A and Bailey T, 1996, Interactive spatial data analysis in medical geography. Social Science & Medicine 42, 6, 843–855.

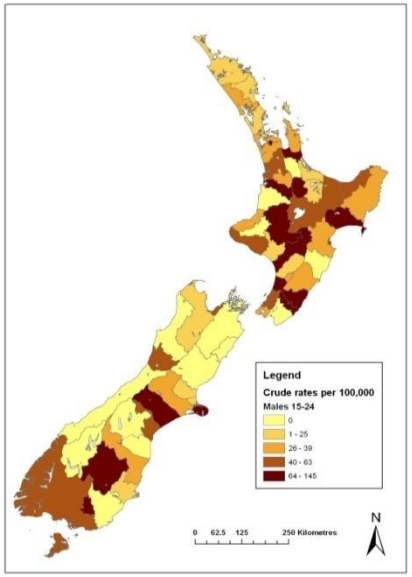
Visualisation of health data



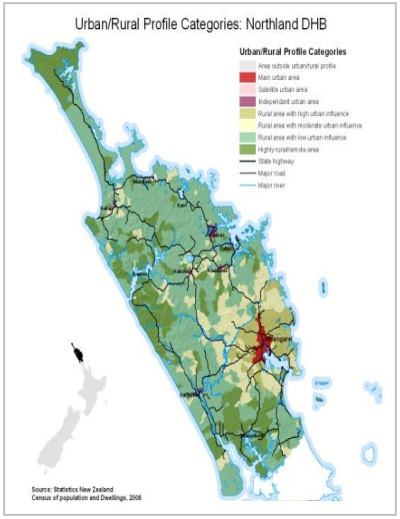
Campylobacter rates 1997-06



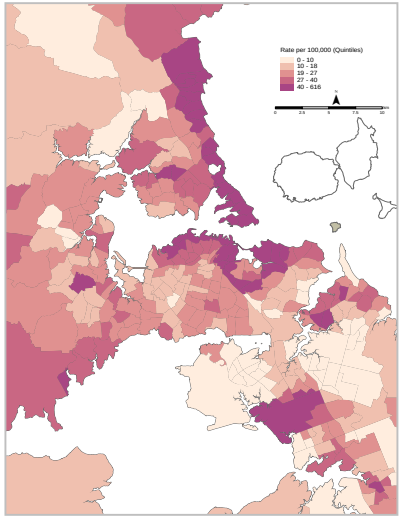
Legionnaires disease rates 15-24 yrs 2003-05



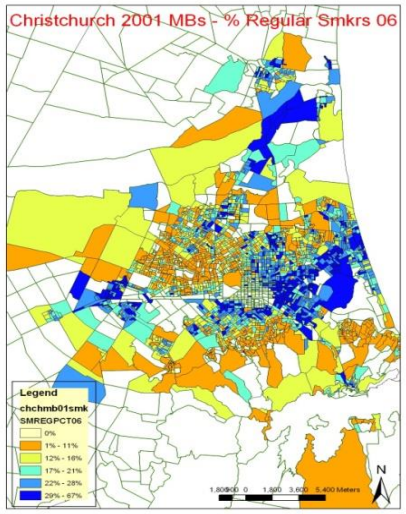
Suicide rates Males 15-24 yrs 2003-05



Urban/rural classification



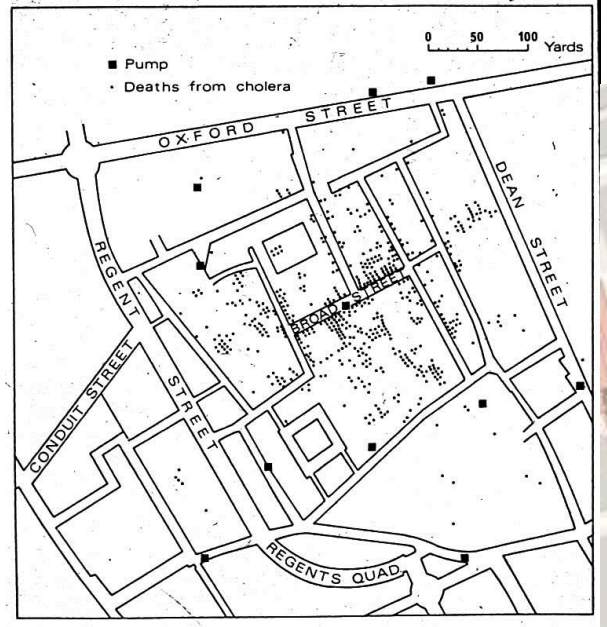
Melanoma rates 30-39 yrs 1995-04



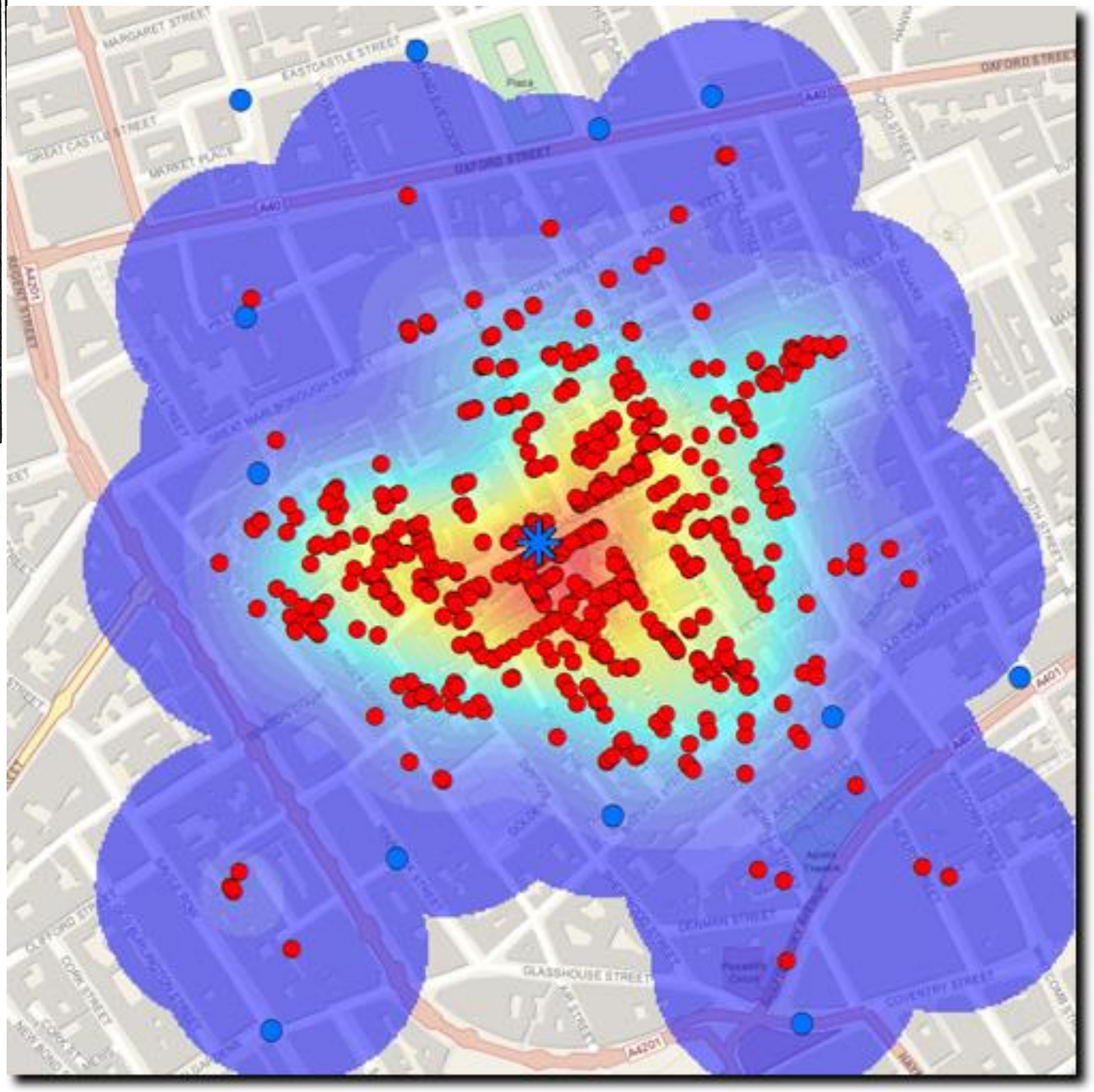
% smokers 2001

Interpretation

- Asking questions
- Inform policy

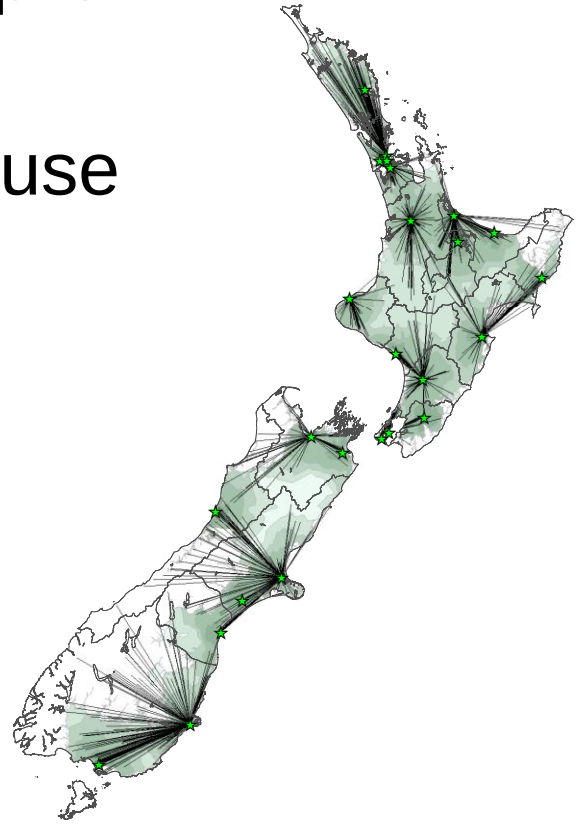


2. Deaths from cholera in the Soho district of London, September 1854. Dr John Snow's celebrated map, which established the connection between the cholera outbreak and a single polluted water pump in Broad Street. This emphasized the importance of supplying pure water to the inhabitants of the growing cities of Britain.



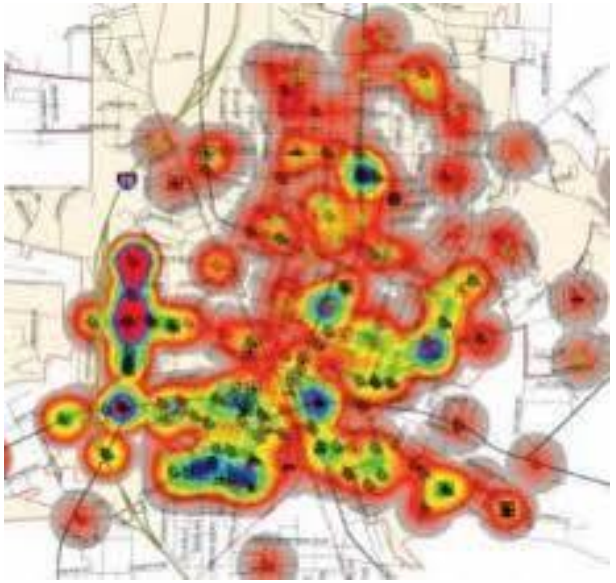
Inequalities in access to and utilisation of health services

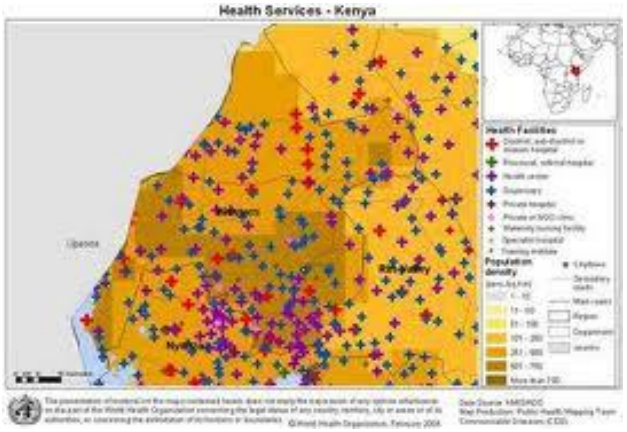
- Neighbourhood deprivation & hospital admissions
- Neighbourhood deprivation & GP use
- Travel time and GP use
- Road closure and health access
- Healthline
- Quitline



		Within 30 minutes		Within 1 hour	
Drive-time scenario	Hospitals	Pop	%	Pop	%
All 24/7 ED Hospitals	25	3,347,940	80.2	3,858,940	**92.5**
Major Hospitals	**13**	**2,880,390**	**69.0**	**3,330,410**	**79.8**

Health care planning and resources





Indices of access/exposure to factors in the built environment

- Creation of exposure indices e.g.
  - Green (parks) and blue (water) space
  - Key resources and destination
  - Social cohesion and isolation
  - Travel time network
  - Urban/rural
  - Earthquakes

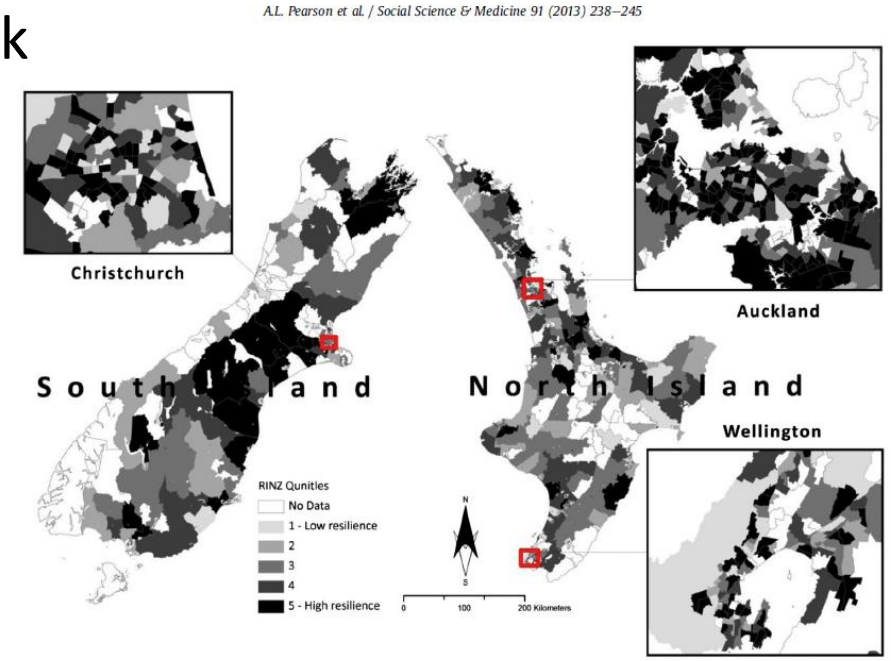


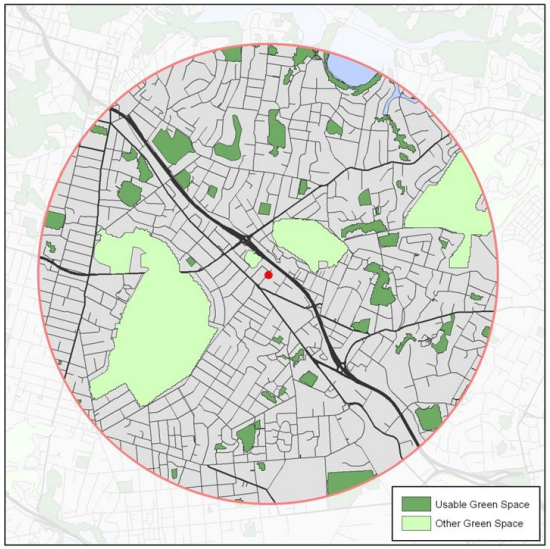
Fig. 1. Map of resilience index values across New Zealand.

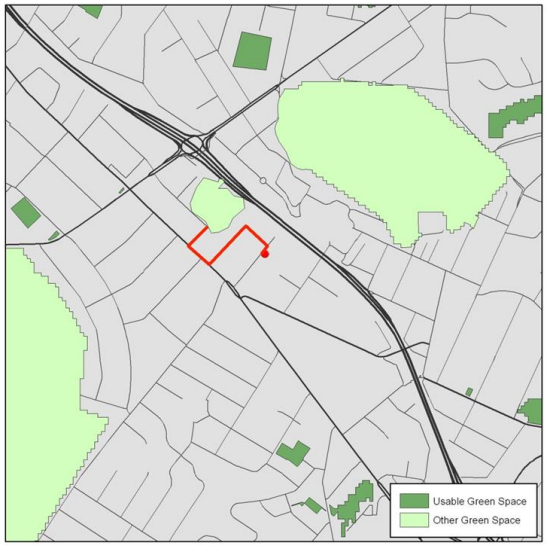
Greenspace and health

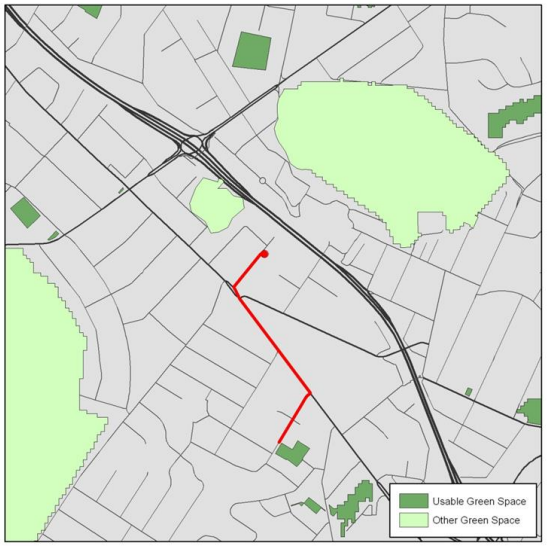
Investigates the mechanisms by which green space availability may influence mortality outcomes, by contrasting health associations for different types of green space

- Availability of green space linked to positive health outcomes

- Usable or non-usable?

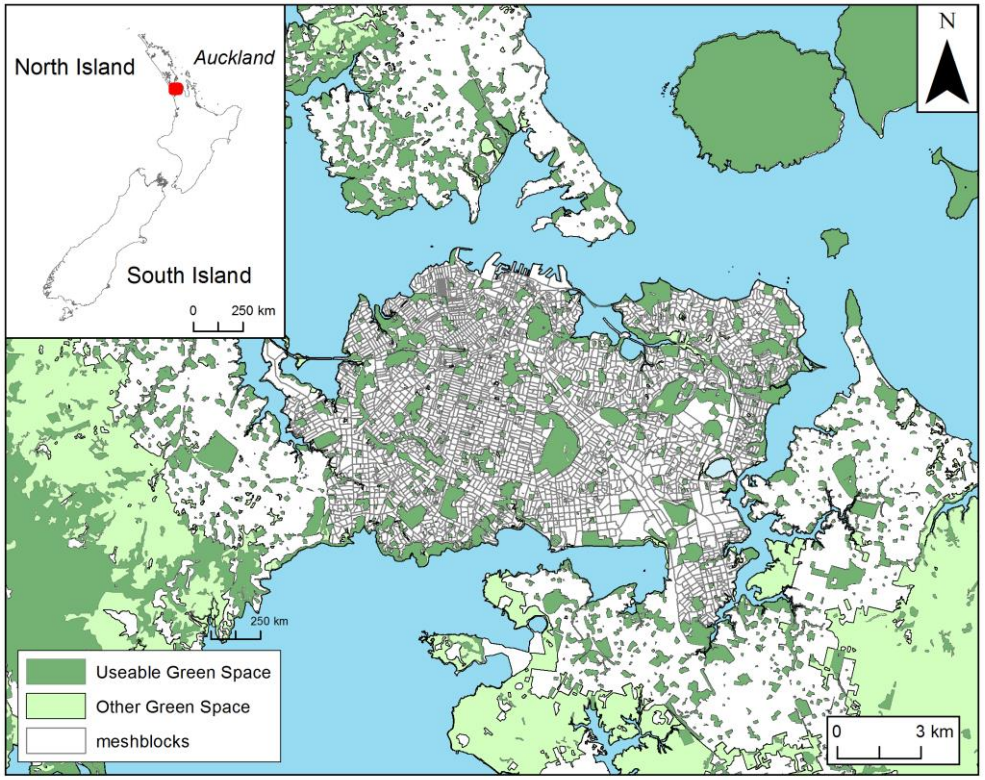






Access to neighbourhood destinations

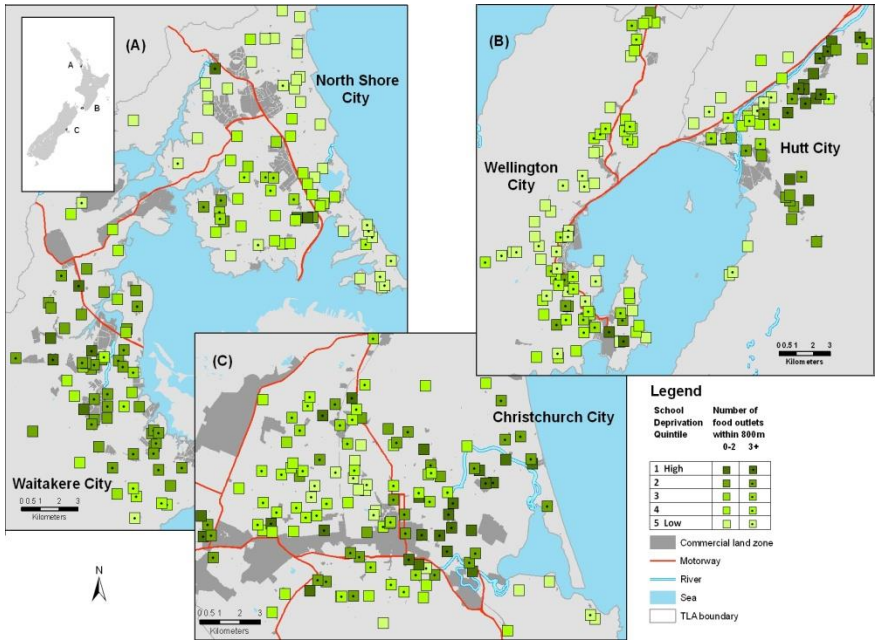
- Access to '*unhealthy*'
  - Tobacco
  - Alcohol
  - '*Unhealthy*' food sources
  - Gambling opportunities
- Access to '*healthy*'
  - Green and blue space
    - proximity vs visual
    - Useable vs non-useable

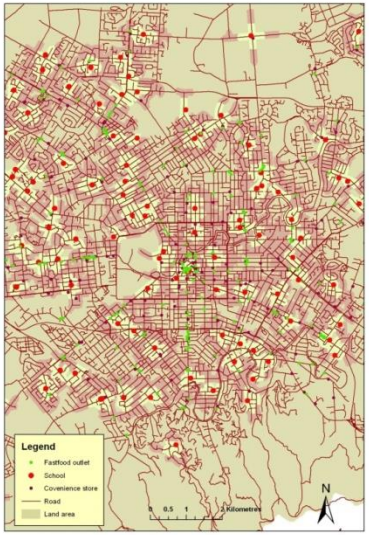


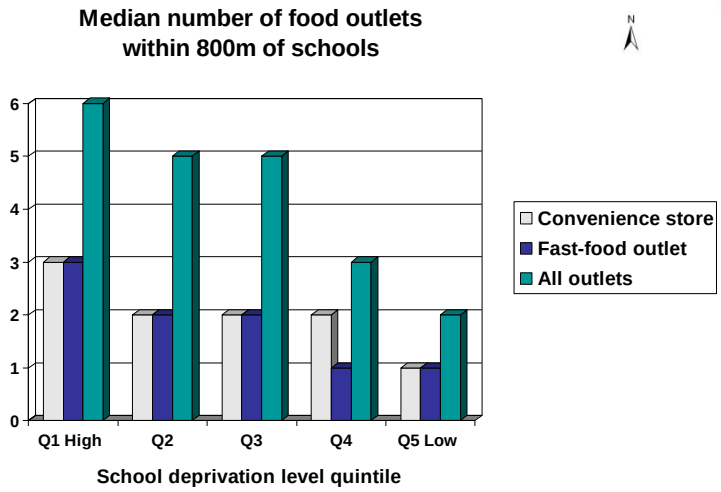
Food environments around schools

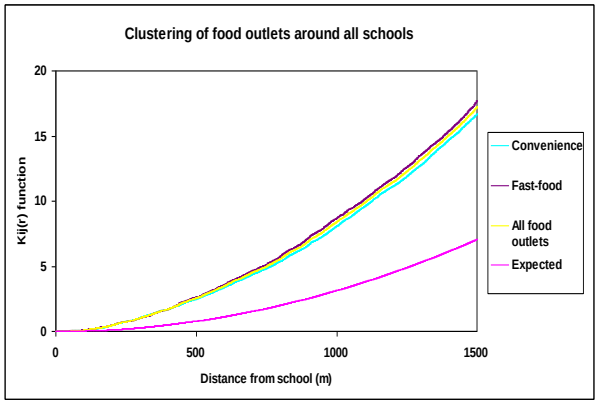
Fast-food outlets are clustered around low decile secondary schools in densely populated and commercial zoned areas

- Food outlet proximity and exposure and access to unhealthy obesity promoting foods
- GIS spatial cluster analysis





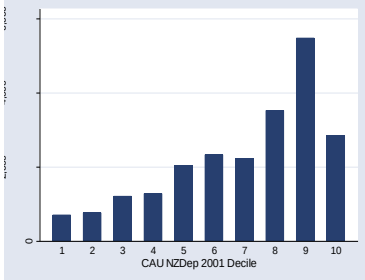




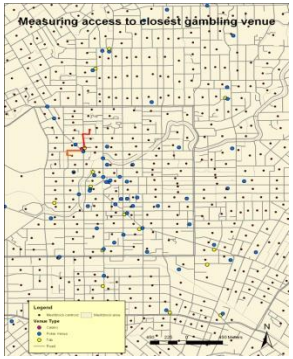
Contextual Explanations of Gambling Behaviour

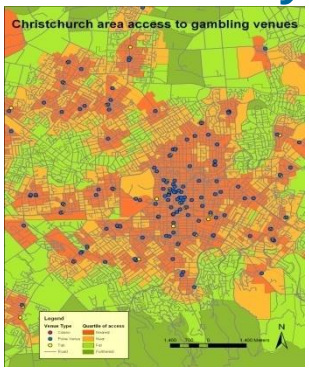
Neighbourhood access to opportunities for gambling is related to gambling and problem gambling behaviour

- Venue location and access patterned by social deprivation

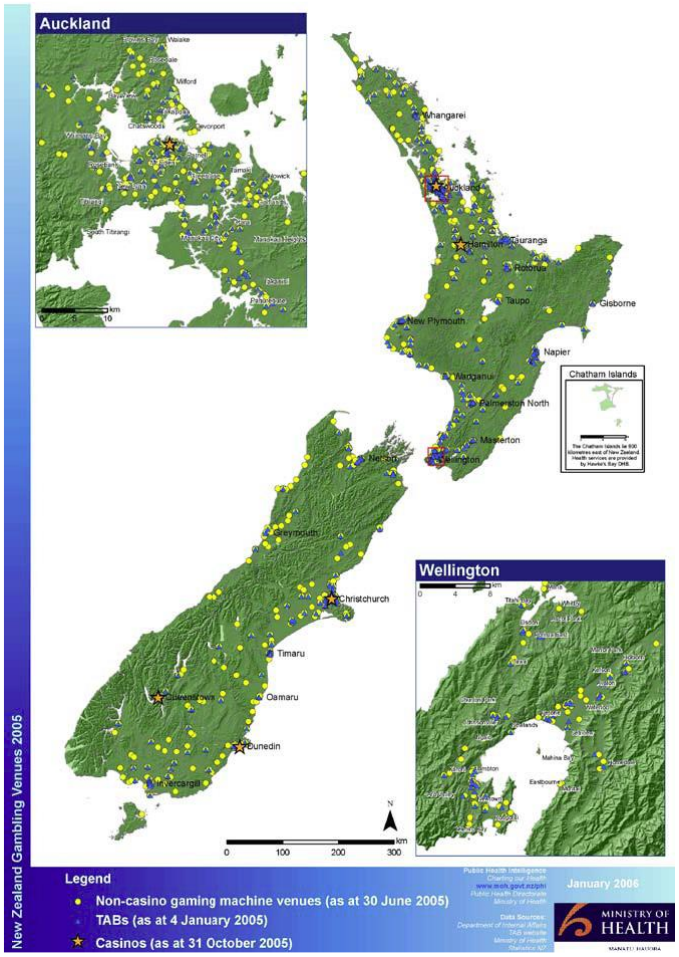


- Location and accessibility



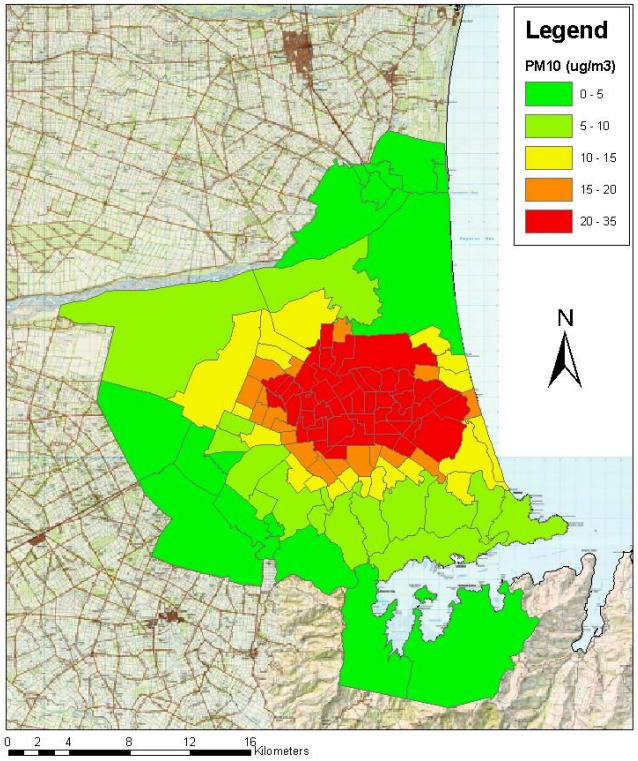


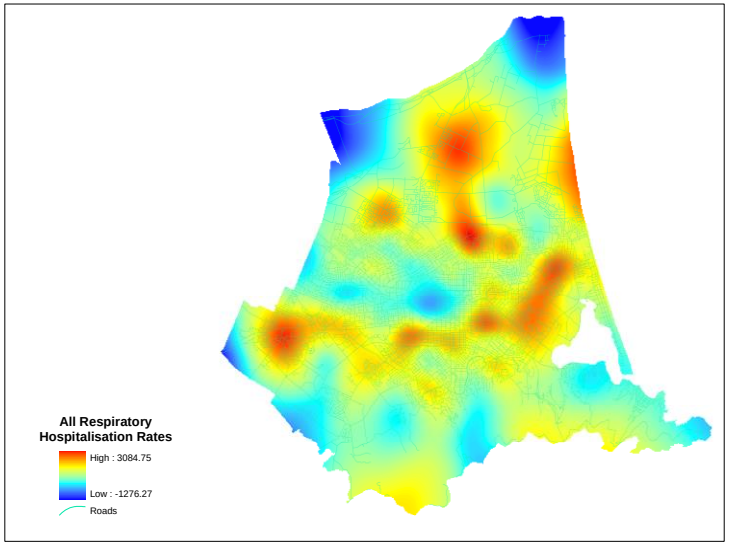
- GIS derived travel distance to the nearest gambling venue



Air quality exposure and health

- Exposure to air pollution
- Environmental justice
- Health impact





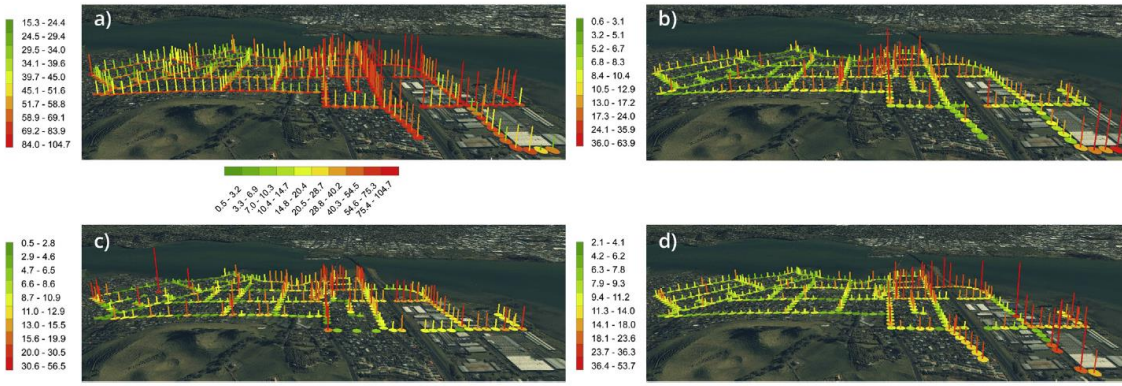
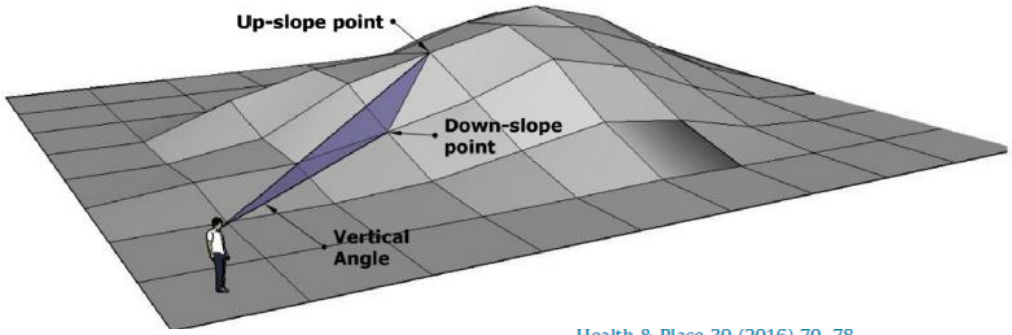


Fig. 12. Median UFP concentrations (pt/cm^3 × 10^3) for Mangere Bridge – a) early morning b) midday c) late afternoon and d) late evening.

Visualisation



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Residential exposure to visible blue space (but not green space) associated with lower psychological distress in a capital city

Daniel Nutsford [a], Amber L. Pearson [b,c,*], Simon Kingham [a], Femke Reitsma [a]

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[b] Michigan State University, Department of Geography, 673 Auditorium Road, East Lansing, MI 48824, USA
[c] University of Otago, Department of Public Health, 23A Mein Street, Wellington 6242, New Zealand

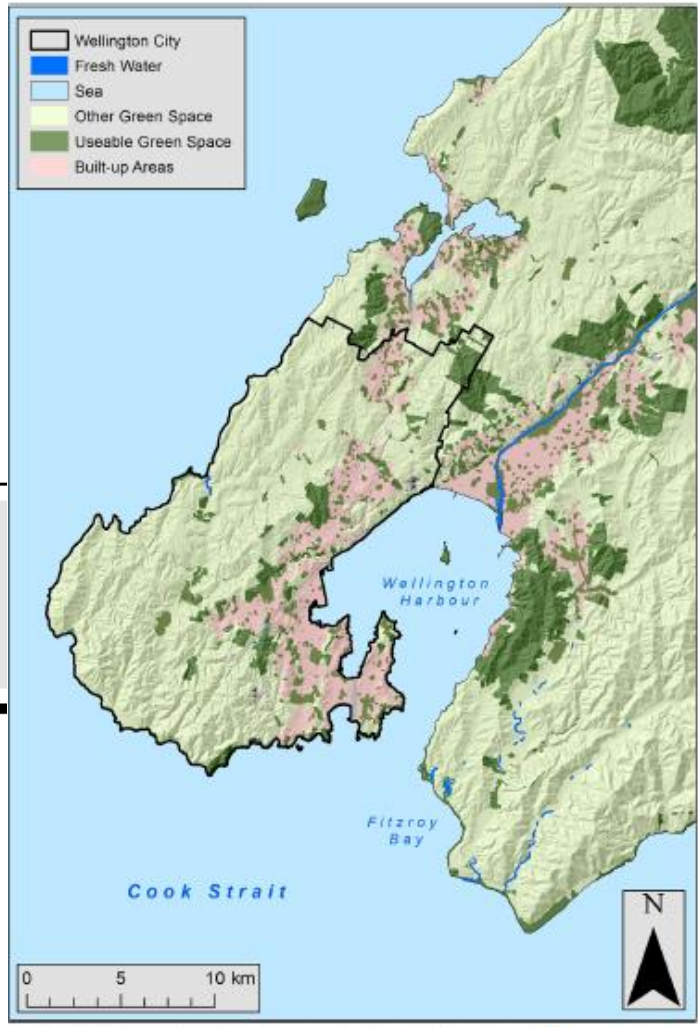
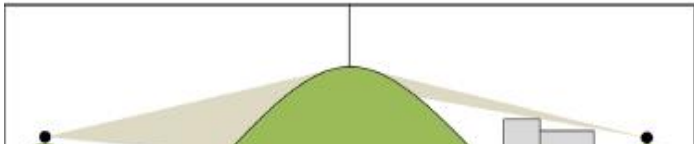
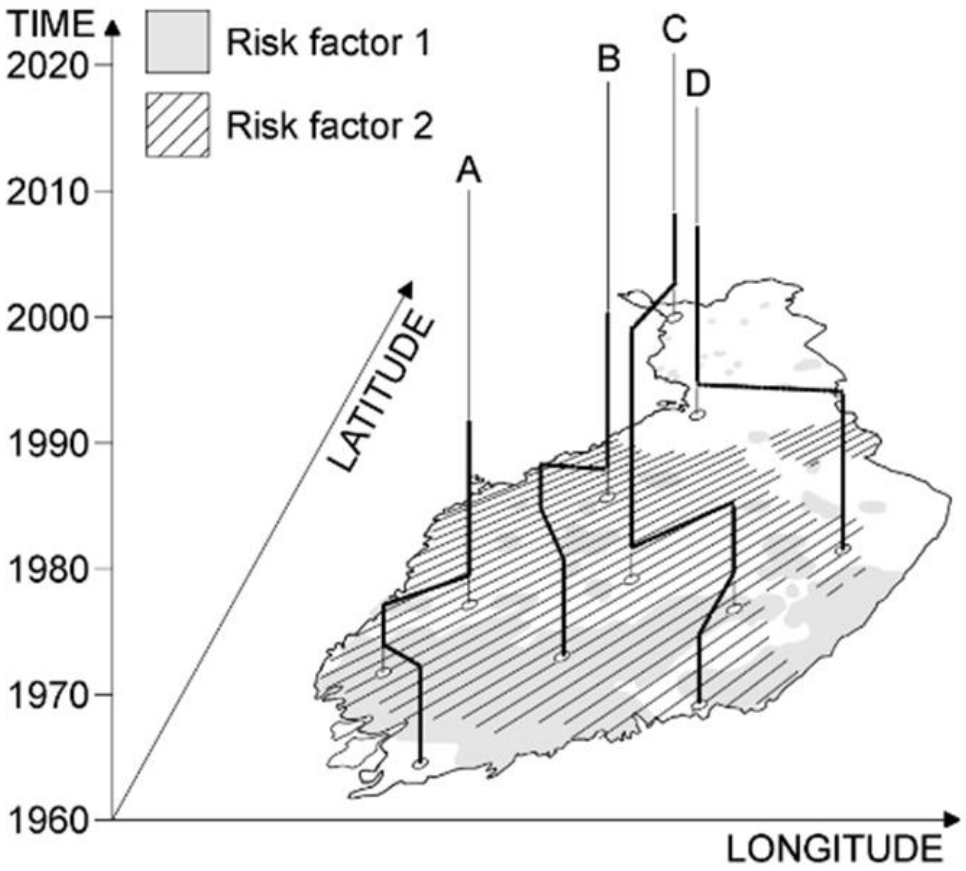


Fig. 1. Distribution of natural environments throughout Wellington City and the greater region.



Personal tracking

- Tracking people
- Life course
- Spatio-temporal
- The exposome

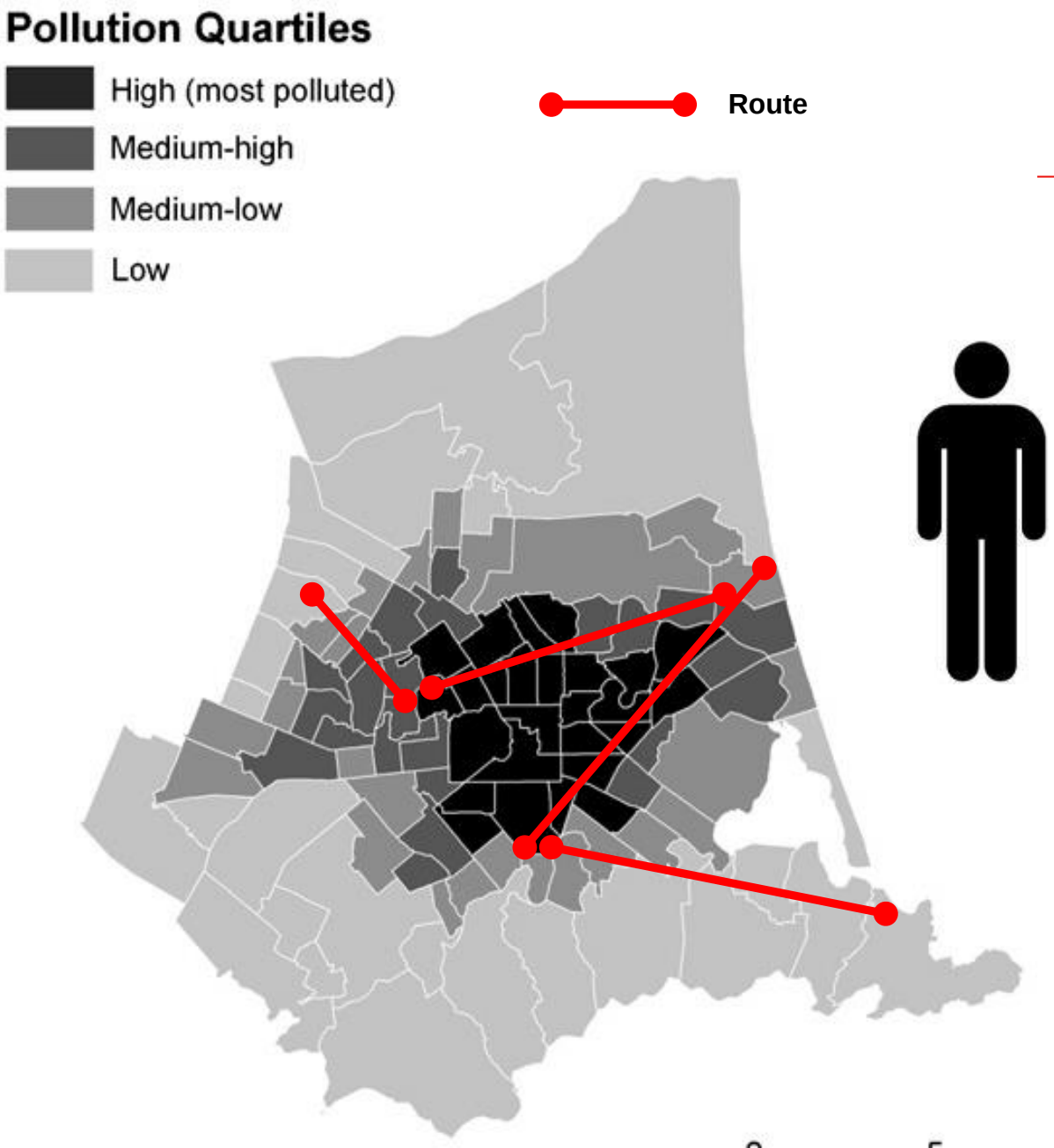


The Sensing City and Health: COPD pilot project

SEN
S ING
CITY

UC GEOHEALTH LABORATORY

What might be an improvement?



- Lets follow a “hypothetical” individual called Tony...
- How does his COPD condition alter as he moves through the smart city?

Social media maps: twitter and illness maps: the flu

About 18,000 daily mentions of specific symptoms on Twitter and uses location data to plot these on a map of the country, updating it in real time.

http://www.ssp.co.jp/stac/#/japan

Colour = symptoms

The GeoHealth Laboratory?

- A partnership between Health & Disability Intelligence (HDI), MoH, & the Department of Geography, UC
- Seeks to advance MoH policy & UC's health sciences research agenda for the mutual benefit of the New Zealand health sector
- Aims to:
  - Build a strategic partnership around health geography, spatial epidemiology, & Geographical Information Systems (GIS)
  - Increase research capacity & research outputs in health & GIS

History

- Launched by the Minister of Health, Nov 2004 at the GeoHealth Conference, Wellington
- Formally opened on the 18th February 2005
- Visited by Prime Minister, Helen Clark 6th May 2005
  - *"I didn't realise geography was so jazzy!*"

Staff and students

- Research staff (postdocs)
- Graduate students
  - Masters and PhD
- UC staff
  - Academics – Geography & other
  - Technical GIS & other support

Graduates

- Kurt Janssen (PHI intern) - MoH, MfE, ESRI, Interpret (Christchurch)
- Katherine Tisch (Masters) – ESR, GeoHealth Lab, Edinburgh Uni
- Erin Holmes (Masters) - MoH (Wellington)
- Kate McPherson (Masters) – Christchurch City Council
- Laura Miller (PhD) – Western Australia Health Department
- Chris Bowie (Masters) – Opus (Wellington)
- Sam Valentine (Masters) - Appian Group (Sydney)
- Matt Willoughby (Masters) - Canterbury District Health Board
- Kimberley Reed (Masters GIS) – Marlborough Lines Ltd
- Dan Nutsford (Masters GIS) – Auckland Council
- Jayden MacRae (Masters) – CEO, Patients First, Wellington
- Nick Brunsdon (Masters) – Canterbury Development Corporation
- Andreas Wilson (Masters) – Christchurch City Council
- Daniel Hogg (PhD) – GIS professional, Germany